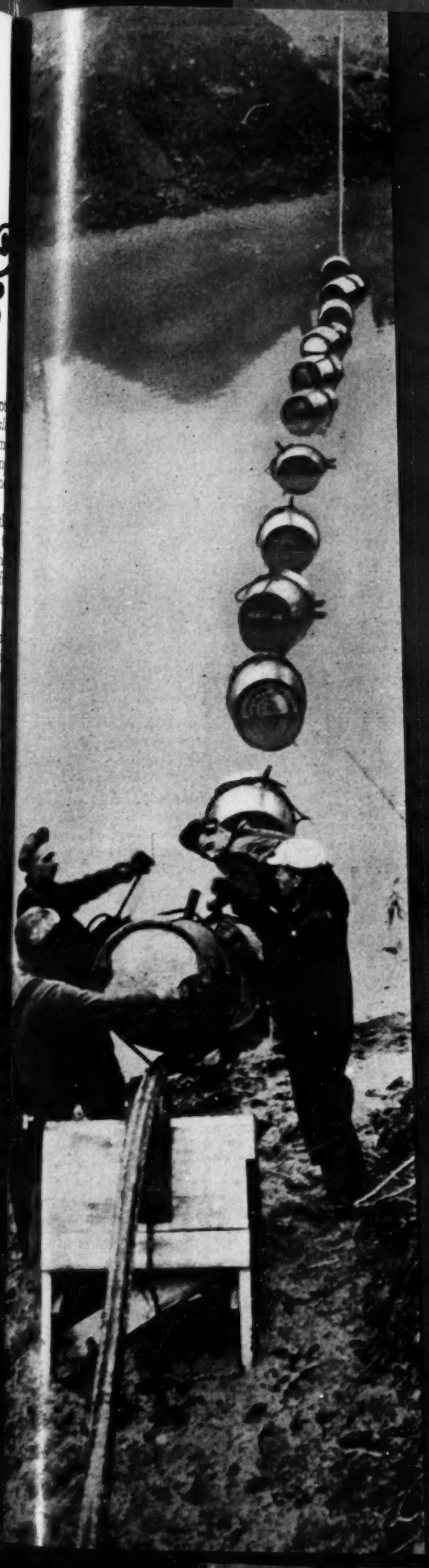

Electrical World

DECEMBER 23, 1944

Russian Power Plant Design

Accidental Ground Detection

Predicting Welder Load

First Power Line F-M Carrier

What About Fast Reclosure?

Steel Drums Float Gas-Filled Cable Across Indiana Stream

"High, wide" — yes, and "handsome", too!

The ladder that never interrupts production

Practically numberless working positions—many inclinations, height-variation foot by foot and full 360° rotation—all with practically automatic operation.

Crows'nests of varying heights, mounted on live skids, caster trailers, carriages, motor trucks or other suitable bases are doing important up-in-the-air jobs — indoors and outdoors — speedily, efficiently, safely. Fluorescent lights mounted over machines or benches are serviced without interrupting production.

Crows'nests are mighty useful, too, for inspecting, building, servicing and repairing planes in nearly every manufacturing plant and at airport after airport. For proposal, specify working height, sideways-reach and aisle-width, if any. No obligation. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Murray crow's'nest

ACCLAIMED AMERICA'S No. 1 MAINTENANCE LADDER — *for indoors and outdoors*

Send for informative technical data

Electrical World

PUBLISHED IN 1874 — READ BY ELECTRICAL MEN FOR 70 YEARS

December 23, 1944

Vol. 122, No. 26

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From .....

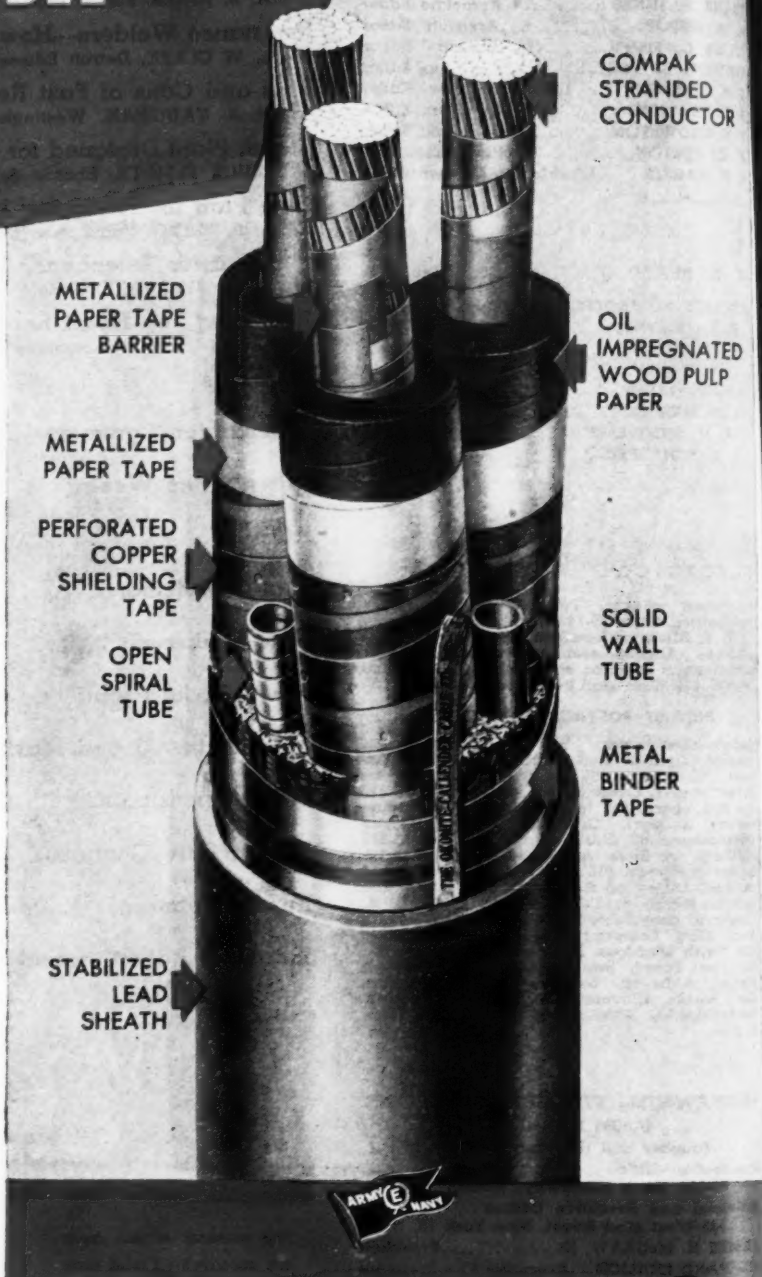
.....

To .....

.....

Signed .....

OKONITE-CALLENDER LOW GAS PRESSURE CABLE



Applications

Okonite-Callender low gas pressure cable can be used wherever solid type cable would normally be installed for operation at 10-40 kv. It can be used to advantage where steep grades give rise to pressure problems with solid or oil-filled cables.

Advantages

- This design prevents development of excessive internal pressures such as occur in solid type cables under heavy load conditions.
- Continued positive pressure reduces the magnitude of ionization.
- Low pressure operation reduces circumferential stress on lead sheath, thus lessening possibility of sheath failure through stretching.
- Oil reservoirs at joints are not required.
- Maintenance and inspection costs are low.
- Installation is simple.

Characteristics

- Self-supervised system through alarm feature signals leak before failure occurs.
- Positive pressure prevents entrance of moisture in event of sheath puncture.
- Problem of pressure on grades is reduced.
- Diameter of 3 conductor cable is smaller for given conductor size.

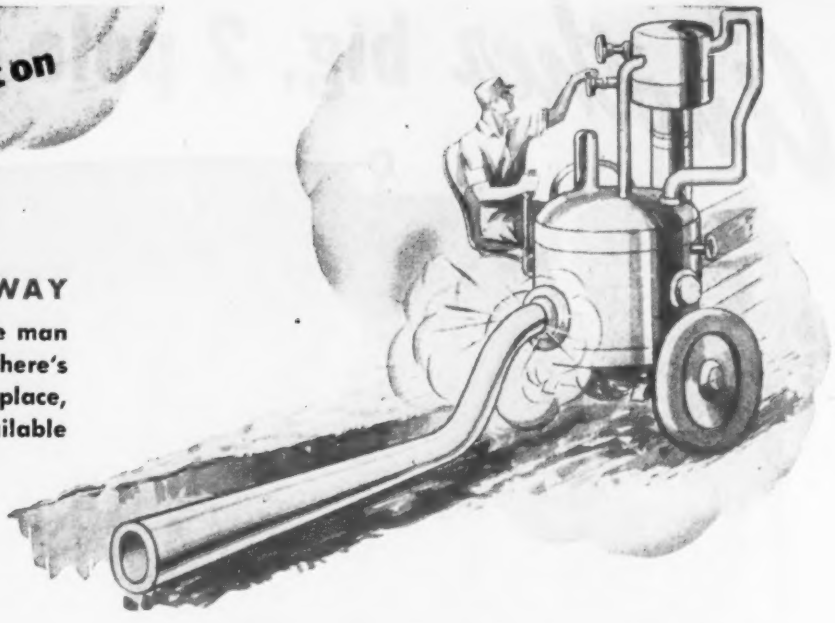
The Okonite-Callender Cable Co., Inc., Executive Offices, Passaic, N. J. . . . Write for Bulletin OK-1023

ARMY (E) NAVY

OKONITE-CALLENDER

PAPER INSULATED POWER CABLES

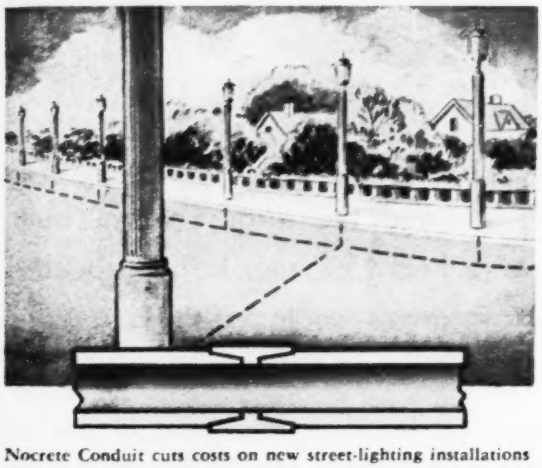
Post-war pipe dreams you better not count on



AN UNDERGROUND RACEWAY THAT'S EXTRUDED IN PLACE—One man makes the conduit, and lays it as well. There's no handling, no joints. Once it hardens in place, you can forget it forever. It may be available some day, but it won't be tomorrow!

BUT RIGHT NOW YOU CAN PLAN TO—

SPEED UNDERGROUND WORK WITH NOCRETE CONDUIT



Nocrete Conduit cuts costs on new street-lighting installations

ORANGEBURG Nocrete Conduit, the ideal raceway for underground cable or wire, is easily handled and installed. Its flexibility enables the duct to follow the contour of the trench, and because it does not chip or break easily, handling losses are at a minimum. Joining requires no compound, and fibre can be sawed to length and field tooled for joining.

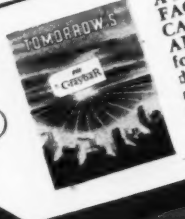
ORANGEBURG'S smooth inner surface reduces cable pulling tension, and prevents damage to cable sheath.

Tight sleeve joints and impermeable walls make ORANGEBURG highly resistant to the entry of fluids. Your Graybar Man will be glad to help you select and apply the right ORANGEBURG conduit for your particular needs.

GRAYBAR'S NATIONWIDE NETWORK

of more than 80 warehouses assures you a convenient local source of supply for more than 60,000 electrical items – backed by experienced power transmission and distribution application aid, plus assistance on problems of lighting, wiring and communication. A Graybar Man near you is ready to make your electrical supply problems his personal responsibility. Why not take advantage of his time-saving assistance? 148

via GraybaR



ATTENTION – MANUFACTURERS OF ELECTRICAL EQUIPMENT AND APPLIANCES: To help plan for more efficient post-war distribution – national or regional – write for this new booklet: "Tomorrow's Electrical Distribution – via Graybar."

GRAYBAR ELECTRIC COMPANY
IN OVER 80 PRINCIPAL CITIES
Executive Offices: 420 Lexington Ave., N. Y. 17, N. Y.

Another big, 2 pole ELLIOTT mo

THIS ONE IS 4000 H. P.

and the largest we've built to date. Largest we've heard of, too, in high-speed synchronous motors. It drives an Ingersoll-Rand gas exhauster on an important war job.

Elliott has been particularly successful in the engineering of these big, 2-pole synchronous motors. They are husky babies, as tough and capable as they look. If you have the kind of drive job that needs a motor like this, talk it over with Elliott engineers.

ELLIOTT COMPANY
Electric Power Dept., RIDGWAY, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

ARMY E NAVY

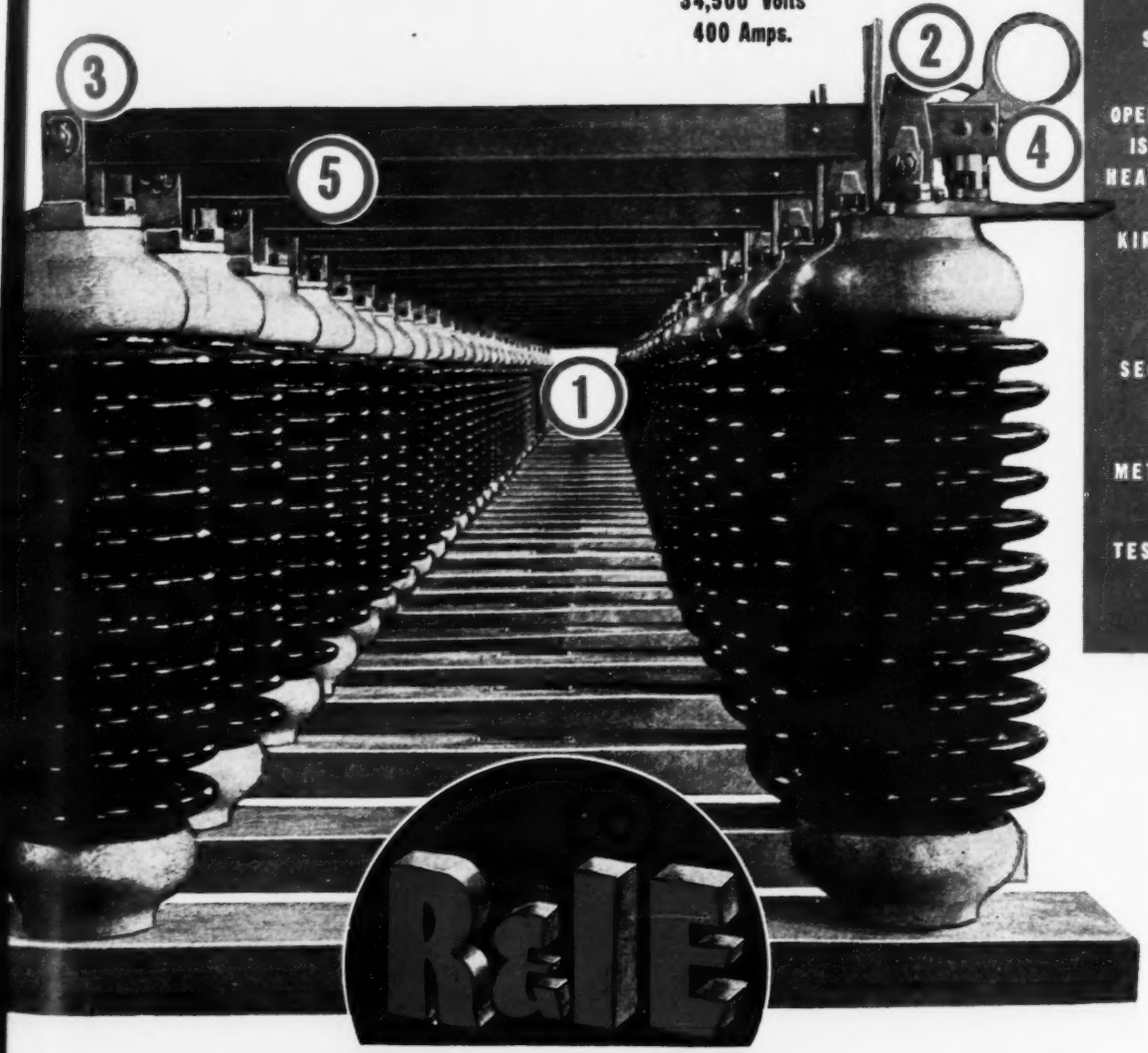
ELLIOTT Company

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECT
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILT

CHECK the FACTS

1. One or one hundred—all Hi-Pressure Contact switches are built with—
2. Hi-Pressure Spot Contacts, self-cleaning with every operation.
3. Hinge contacts—uniform in all blade positions through Hi-Pressure, annular line contact surface—dirt free, smooth operation.
4. Positive latching and unlatching controlled by integral pry-out lock.
5. Double trussed blade for strength, rigidity and contact alignment.

TYPE HPS
34,500 Volts
400 Amps.



The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

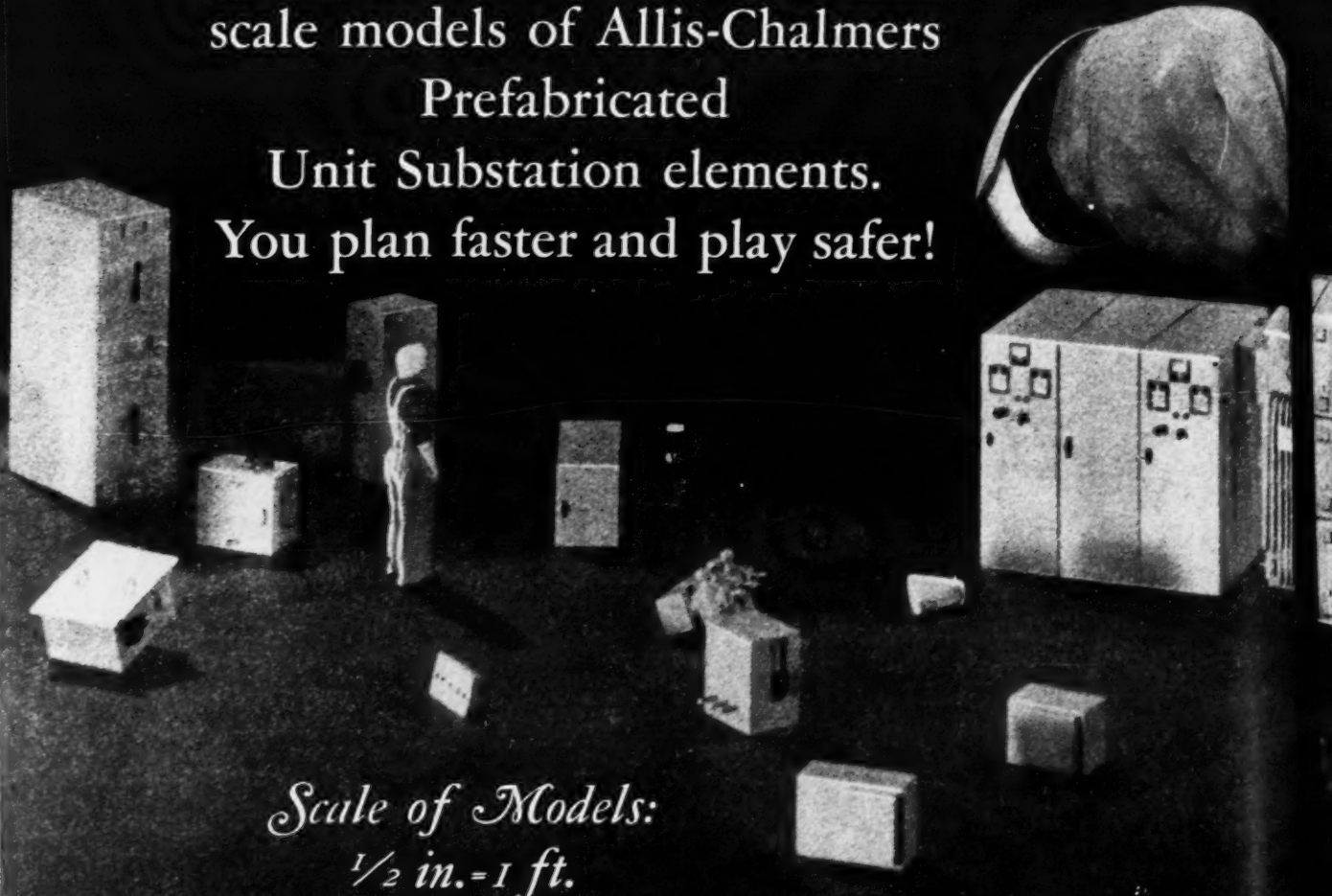
R&IE

DISCONNECTING SWITCHES

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
BRANCH IN CANADA — EASTERN POWER DEVICES, LIMITED, TORONTO

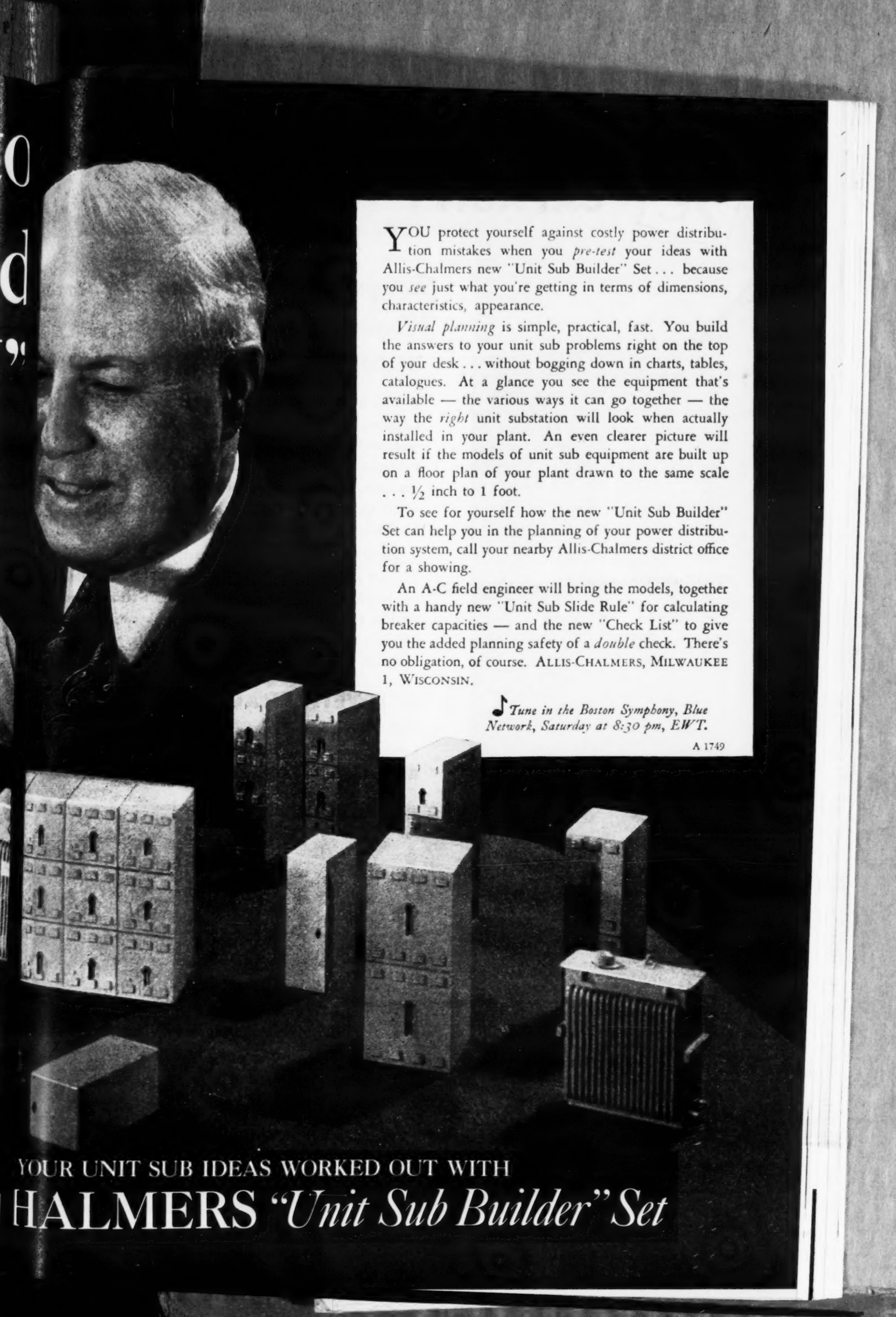
Say Goodbye to "BY-GUESS and BY-MEMORY"

That's what you do
when you plan unit substations
visually — with new
scale models of Allis-Chalmers
Prefabricated
Unit Substation elements.
You plan faster and play safer!

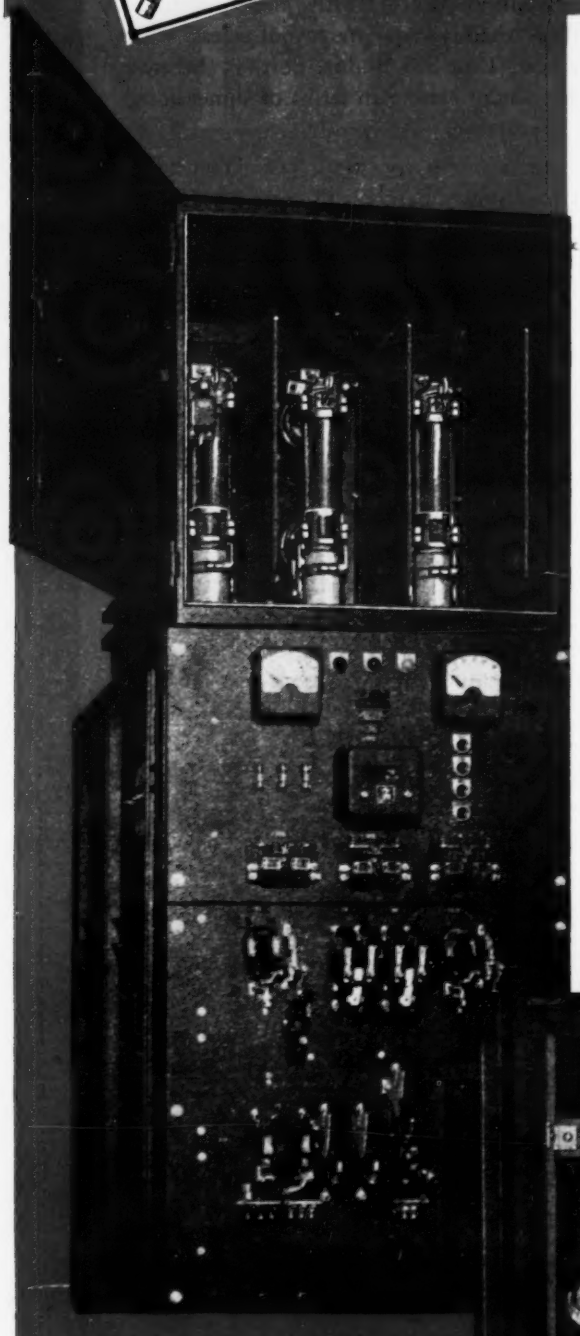


Scale of Models:
1/2 in.=1 ft.

ALLI


YOU protect yourself against costly power distribution mistakes when you *pre-test* your ideas with Allis-Chalmers new "Unit Sub Builder" Set . . . because you *see* just what you're getting in terms of dimensions, characteristics, appearance.
Visual planning is simple, practical, fast. You build the answers to your unit sub problems right on the top of your desk . . . without bogging down in charts, tables, catalogues. At a glance you see the equipment that's available — the various ways it can go together — the way the *right* unit substation will look when actually installed in your plant. An even clearer picture will result if the models of unit sub equipment are built up on a floor plan of your plant drawn to the same scale . . . ½ inch to 1 foot.
To see for yourself how the new "Unit Sub Builder" Set can help you in the planning of your power distribution system, call your nearby Allis-Chalmers district office for a showing.
An A-C field engineer will bring the models, together with a handy new "Unit Sub Slide Rule" for calculating breaker capacities — and the new "Check List" to give you the added planning safety of a *double* check. There's no obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.
♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*
A 1749
YOUR UNIT SUB IDEAS WORKED OUT WITH
HALMERS *"Unit Sub Builder" Set*

HIGH-INTERRUPTING CAPACITY POWER FUSES



S & C High-Interrupting Capacity Power Fuses provide reliable short-circuit protection to the equipment and the system without involving related apparatus . . . a splendid example of modern engineering practice. Close-up at right shows one of these disconnect fuses in open position.

Give your High Voltage Motors Modern Low Cost

SHORT-CIRCUIT PROTECTION

• The accepted use of S & C High-Interrupting Capacity Power Fuses by leading builders of 2300 and 4600 volt motor control equipment is good evidence of satisfactory performance. They provide accurate, dependable short-circuit protection in small space—at lower cost, and eliminate the need for back-up circuit breakers.

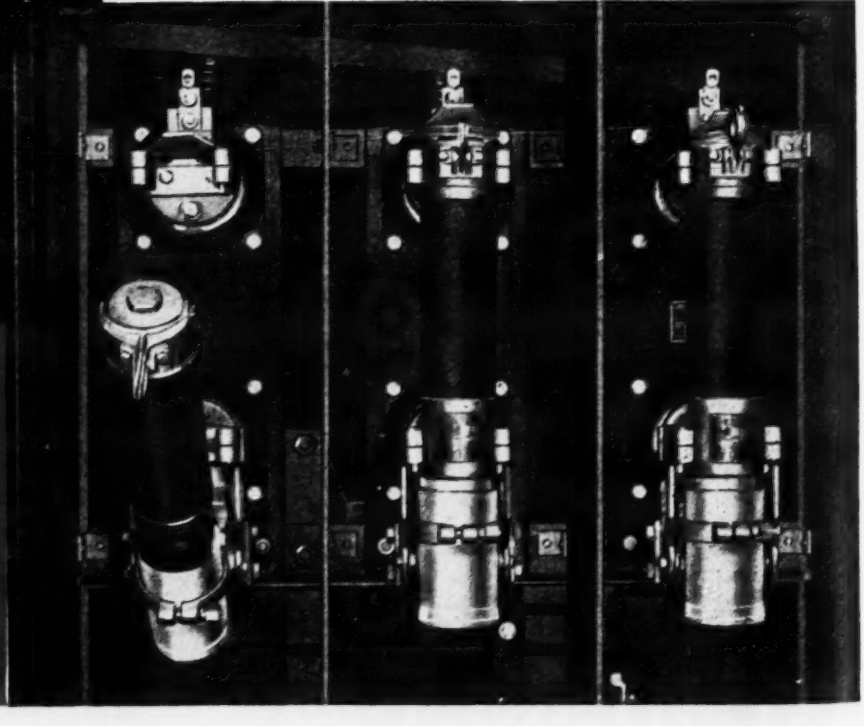
These S & C Power Fuses, easily serviced on the job, are precision-built with traditional S & C thoroughness. They provide reliable short-circuit protection up to 150,000 KVA at 2300 volts and to 250,000 KVA at 4600 volts. For details, write for Bulletin 200.

SCHWEITZER & CONRAD, INC.

4421 Ravenswood Ave., Chicago 40, U. S. A.

Supplied in Canada through Powerlite Devices, Ltd., Toronto, Ont.

Experience Will Choose the S & C Fuse



Season's Greetings

As we draw near to the close of a year made difficult by the confusion of global war, we pause to extend the Season's Greetings to our friends and customers and to express our gratitude to those who have been so patient and understanding during the months when we could not give them the Simplex service to which they were accustomed. We sincerely hope that the new year may bring peace to our war-weary world and to each of you a large measure of health, happiness and prosperity.

SIMPLEX WIRE & CABLE CO.

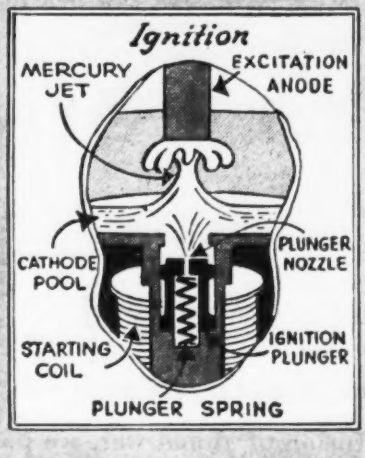
79 Sidney Street, Cambridge 39, Mass.

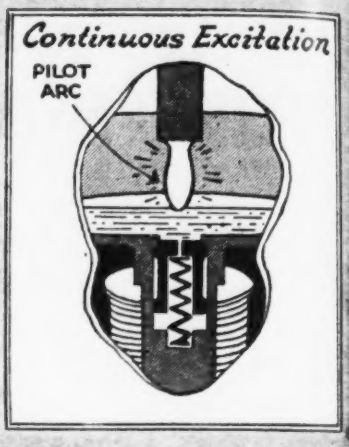
GET STABLE D-C

WITH EXCITRON MERCURY ARC RECTIFIERS!

Here's the Excitron Principle . . .

Allis-Chalmers Excitron employs simple, one-time ignition for "continuous excitation". To close circuit, plunger beneath mercury surface shoots jet up to excitation anode . . . which is safe distance above mercury cathode, *cannot be affected by impurities or turbulence on mercury surface.* When jet collapses, pilot arc remains.





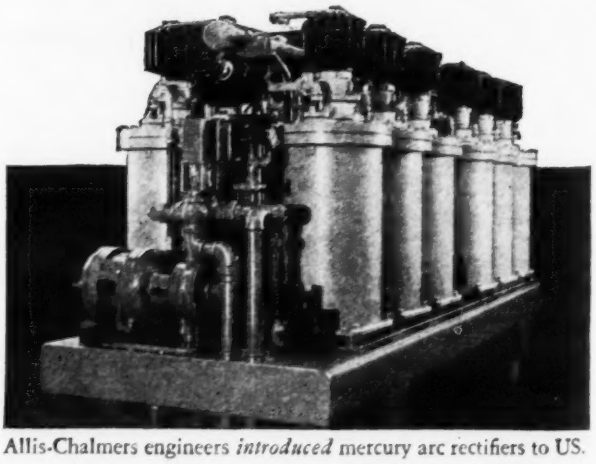
☛ Allis-Chalmers' Excitron is the only single anode mercury arc rectifier which gives you the advantages of "continuous excitation".

☛ There are no ignition impulses to be synchronized with main anode voltage. Tubes don't require re-ignition at the start of each positive half-cycle.

☛ Only Excitron uses direct current from a 3-phase source for excitation of the tube. Thus, stability of excitation cannot be affected by average single-phase dips in a-c system voltage.

☛ Excitron has a simple excitation circuit which requires no "tuning" to maintain proper wave shape. Once adjusted at factory, no further adjustment needed.

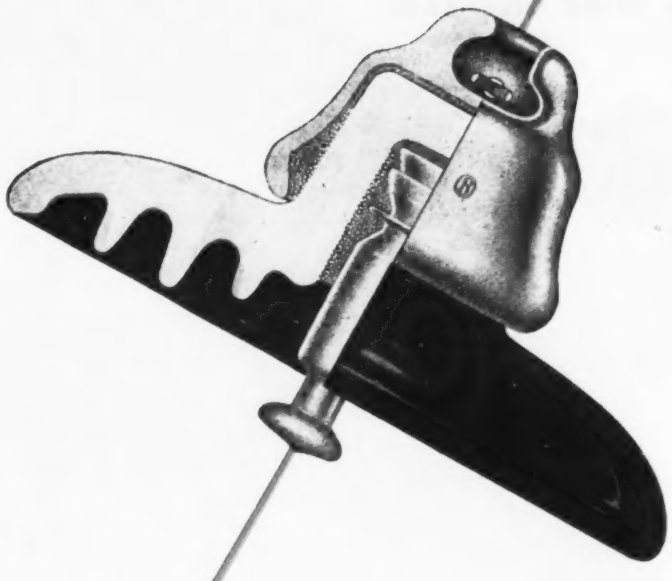
☛ Write Allis-Chalmers, Milwaukee 1, Wisconsin, for the Excitron answer to all your power conversion problems. A 1717



Allis-Chalmers engineers *introduced* mercury arc rectifiers to US.

ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS

Some Sound Sense On The Subject Of Suspension Insulators



THE biggest difference between various makes of suspension insulators is in the realm of mechanics. Electrical values are highly standardized. Design - construction - mechanical strength - finally, actual service, have been objects of continuous research... When you buy a suspension insulator, your choice is based primarily on mechanical considerations. How well and how long that insulator serves is a matter of mechanical integrity... You don't prove true mechanical values in a laboratory. Gradual changes occurring from constant cycles of load and temperature cannot be reproduced in proper sequence. And, on this account, you don't embark lightly on radical new designs... O-B has this to say: there are at present, 23,000,000 O-B suspension units in service. In time and number, this record is unique. Statistics dealing in large quantities, long time, and infinite applications show an equally unique low depreciation rate for O-B. No claims we could make can alter the facts. O-B has adhered to sound, conservative mechanical design that it developed and that vast experience has proved. It's all a matter of record that is open to you... Your wisest and safest choice in buying suspension insulators is O-B.

2477-H

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED, NIAGARA FALLS, ONTARIO, CANADA

AN overloaded or short-circuited electrical line—wires get hot—insulation bursts into flame—acts like a fuse, carrying fire to all parts of the plant. Another disaster that might have been prevented.

Fires like that *will* be prevented in the future through the use of flame-resisting, self-extinguishing GEON, the raw material for electrical insulation that combines outstanding electrical properties with positive resistance to burning. But those are just two of the properties of this polyvinyl material that will offer many *new* advantages in industrial, domestic and utility wiring.

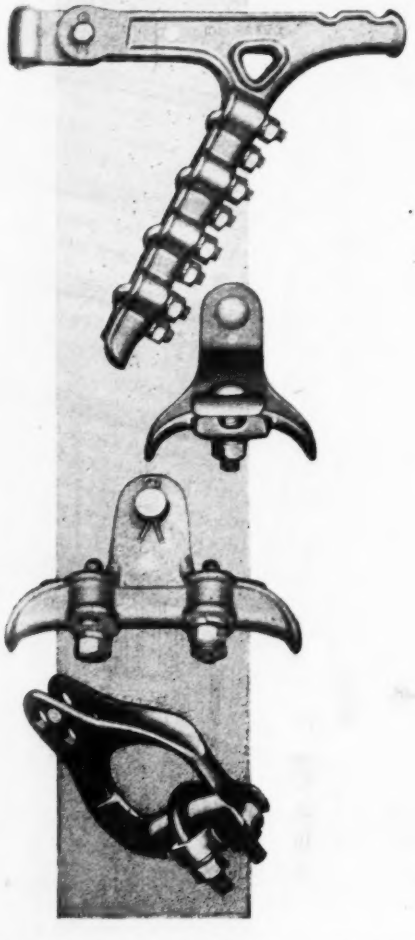
For example, insulation of GEON will last almost indefinitely because it resists ozone, air and sunlight. It's electrical properties will permit a thinner layer of insulation—make possible more conductors, more capacity per conduit. The outer surface of GEON insulation is smooth and slick to permit faster installation. It can be made in a wide variety of colors for quick identification. Its resistance to heat and cold means perfect performance under severe conditions. Its imperviousness to acids and water will permit safe and economical underground use. These many desirable properties can be had in a wide variety of combinations to meet specific service conditions.

Right now all the GEONS are subject to allocation by the War Production Board. Limited quantities can be had for experiment—and our development staff and laboratory facilities are available to help you work out any special problems or applications. For more complete information write department C-7, Chemical Division, The B. F. Goodrich Company, 324 Rose Building, E. Ninth and Prospect, Cleveland 15, Ohio.

CHEMICAL DIVISION
THE B. F. GOODRICH COMPANY
ROSE BUILDING, E. NINTH & PROSPECT, CLEVELAND 15, OHIO

Geon
Polyvinyl Materials

WHY MALLEABLE IRON IS USED - - - - BY O-B



GIVEN A METAL with known tensile strength, you simply use enough of it to arrive at a desired strength in your product. But, when you have done this, and then remove part of that metal with a file, that product is weakened...This is one way of expressing why O-B uses malleable iron in its transmission hardware. When new, a piece has definite and adequate strength. Because it is malleable iron it won't "dissolve away" by corrosion. Malleable, on first rusting, forms a coating of iron-oxide that sticks tight. This oxide won't corrode further, and it won't let go and expose fresh metal to progressive attack. One rusting, and it's protected by nature from then on... That's one good reason why O-B uses malleable in its hardware. That's why this hardware stays put and keeps its full strength year after year. That's a reason why you should specify O-B hardware on your construction plans.

2486-H

Ohio Brass

MANSFIELD, OHIO

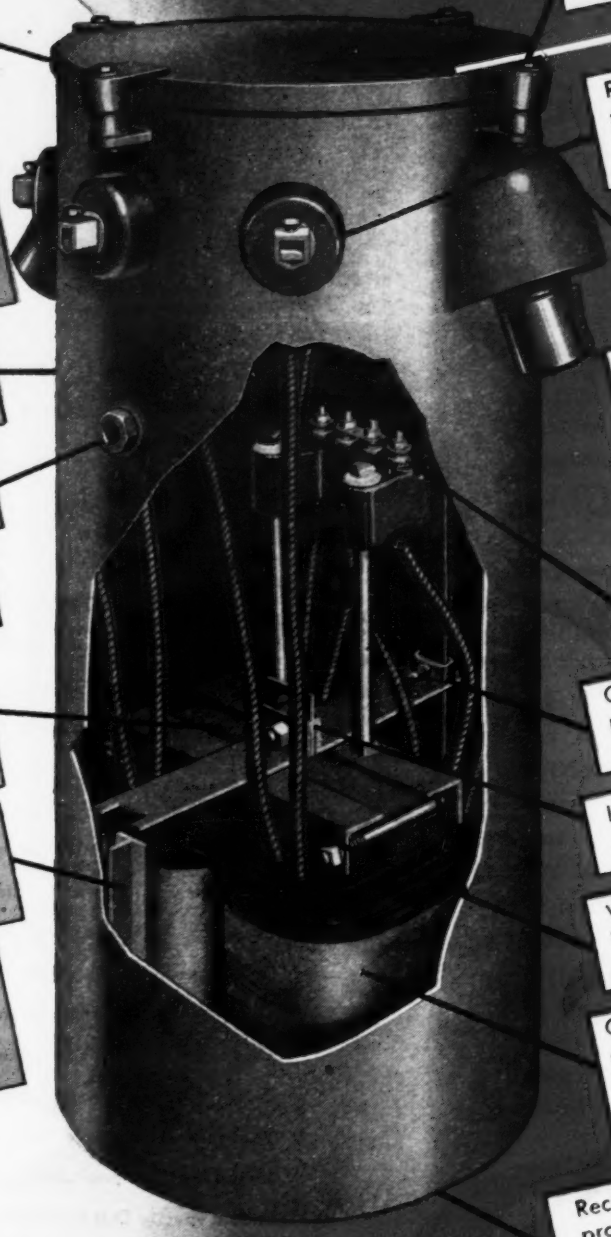
CANADIAN OHIO BRASS COMPANY, LIMITED, NIAGARA FALLS, ONTARIO.

LET THESE TIME-PROVED FEATURES

work for you!

Standard

TRADE MARK



Cover gasket of treated cork gives complete moisture-proof seal and prevents oil leakage. Each unit pressure tested.

(Not shown) Tank support lugs solidly welded to rear of tank for direct pole mounting. Jump-proof lips formed on upper lugs. Will accommodate cross arm hangers.

Tank of copper-bearing steel with seams electrically welded.

Tapped pad for grounding secondary neutral to tank.

Tapped pad for grounding tank. (Not shown)

Core assembly of non-aging, low-loss, varnish coated silicon steel sheets, sheared and annealed to reduce core losses.

Steel T-bars welded to tank for easy insertion or removal of element assembly. Prevent movement in tank.

(Not shown) Nameplate pad positioned and designed in accordance with ASA standards. Space provided for users plate.

Cover readily removed by loosening and rotating hold-down fingers. Entire interior is thus exposed.

Removable low voltage stud type bushings with approved solderless connectors.

Pressed steel overhanging pocket electrically welded to tank gives protection to porcelain bushing.

High voltage pocket type bushings are brown glaze, wet process porcelain with solderless connectors. Coordinated so that flashover will occur externally rather than internally.

Porcelain tap-changing block, connections easy to see and change.

Clamps bolted to T-bar prevent vertical movement of element assembly.

Lifting ring for easy handling of element assembly.

Well-designed core clamping assures quiet and efficient operation.

Coil wound in two sections doubles heat radiation. Ends not blanketed, thus inducing free and effective oil circulation.

Recessed flanged bottom provides extra mechanical strength and prevents damage in handling.

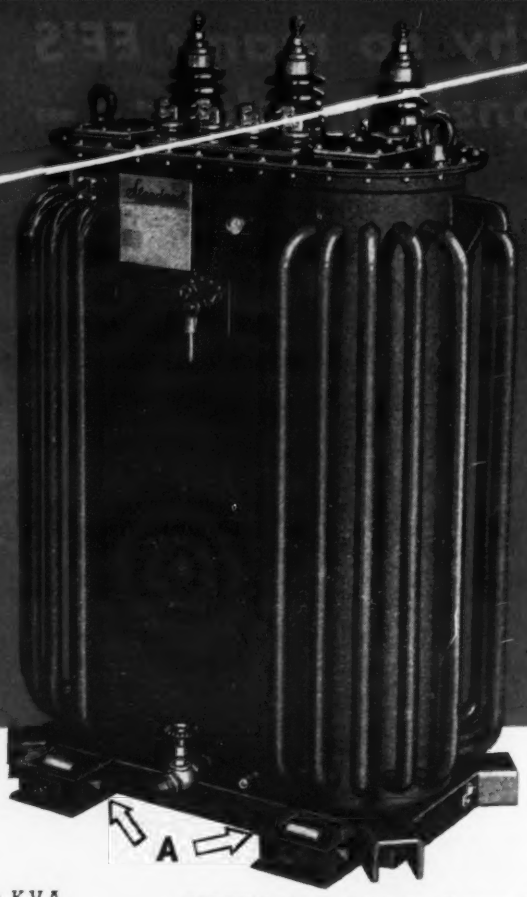
Write

for full information on Standard Transformers of the sizes and types used on your properties.

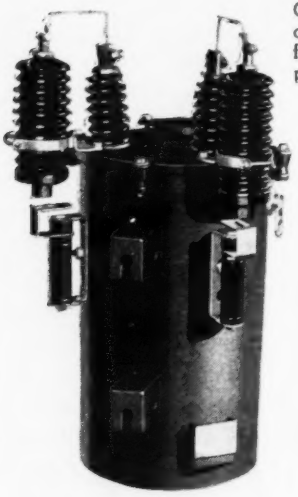
STANDARD TRANSFORMER

DISTRIBUTION TRANSFORMERS

STANDARD 150 KVA transformer rated 4800 to 120/240 volts using welded on radiators for cooling.



250 KVA, three phase transformer. Special rollers (A) shown on bottom of tank is an example of STANDARD engineering to meet individual specifications.



Completely Self Protected type, with cover stud type high voltage bushings for 7200 volt service. Also made with pocket type high voltage bushings.

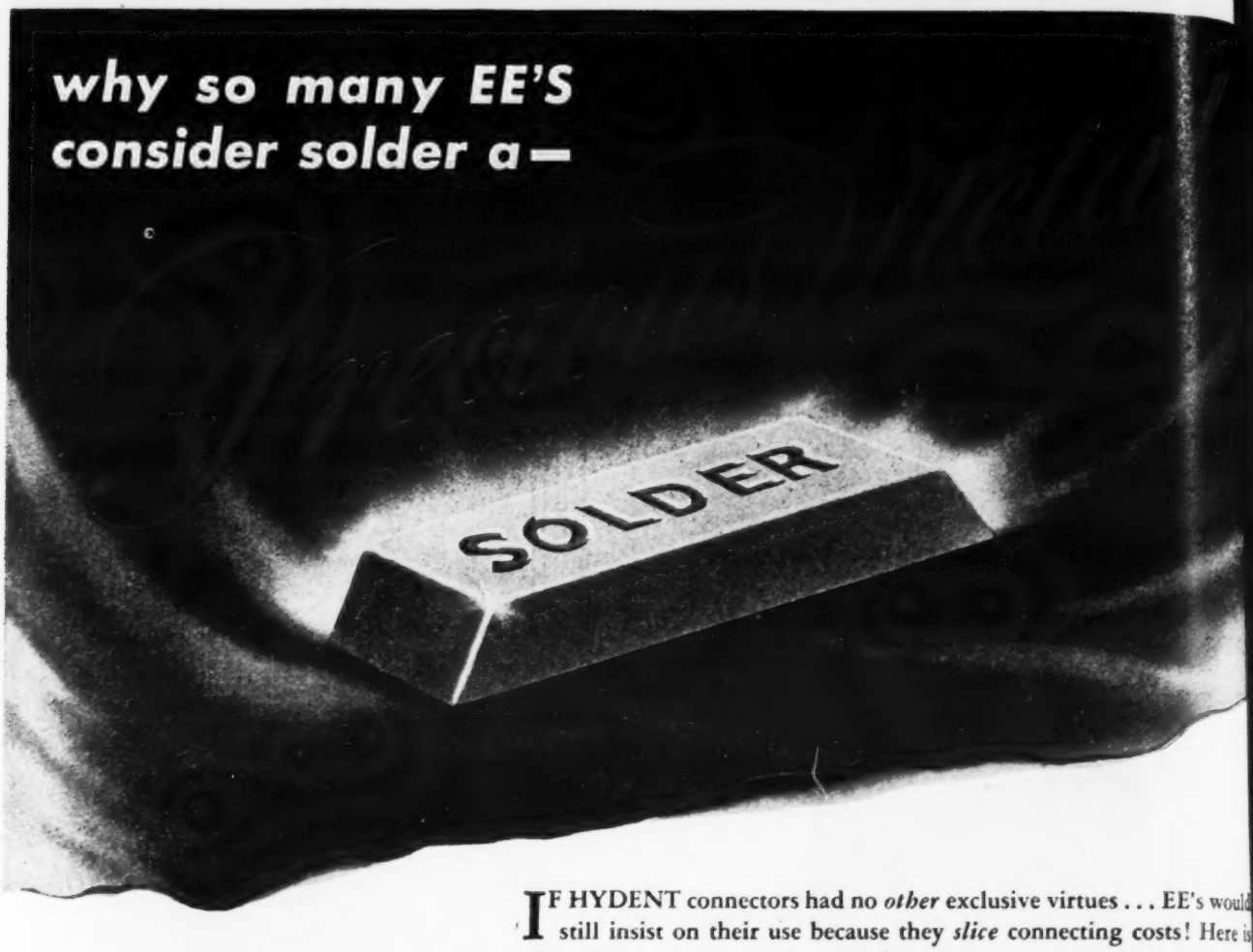
Typical construction of STANDARD round tank distribution type. Cover mounted or side wall pocket type high voltage bushings offered. Designs are all in full accord with ASA standards.

25 KVA, three phase unit, 6900 to 120/208Y volts. Fits many applications where space is limited and effects economies in installation.

OMPANY WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

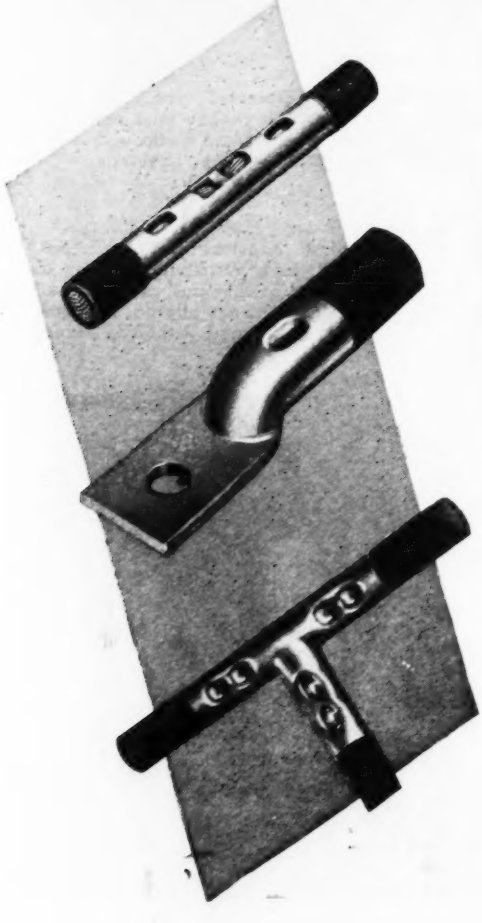
(Makers of Transformers for: Distribution, Power, Metering, Street Lighting, Testing; Dry and Liquid Filled Types.)

why so many EE'S consider solder a—



IF HYDENT connectors had no *other* exclusive virtues . . . EE's would still insist on their use because they *slice* connecting costs! Here is about how a cost comparison works out:

	Solder connection	HYDENT (Indent Type) connection	
Connector Cost	100	100	virtually a stand-off
Solder Cost	100	—	a total saving
Labor Cost (Installing)	100	10 to 20	a *big* saving



But on all other counts, too, the HYDENT (indent-type) connection ranks equally high. It saves space, because it's more compact; it's strong mechanically, efficient electrically, and it has proved beyond doubt . . . through service records extending back for years . . . that indenting is the one way to make permanent electrical connections *permanent.*

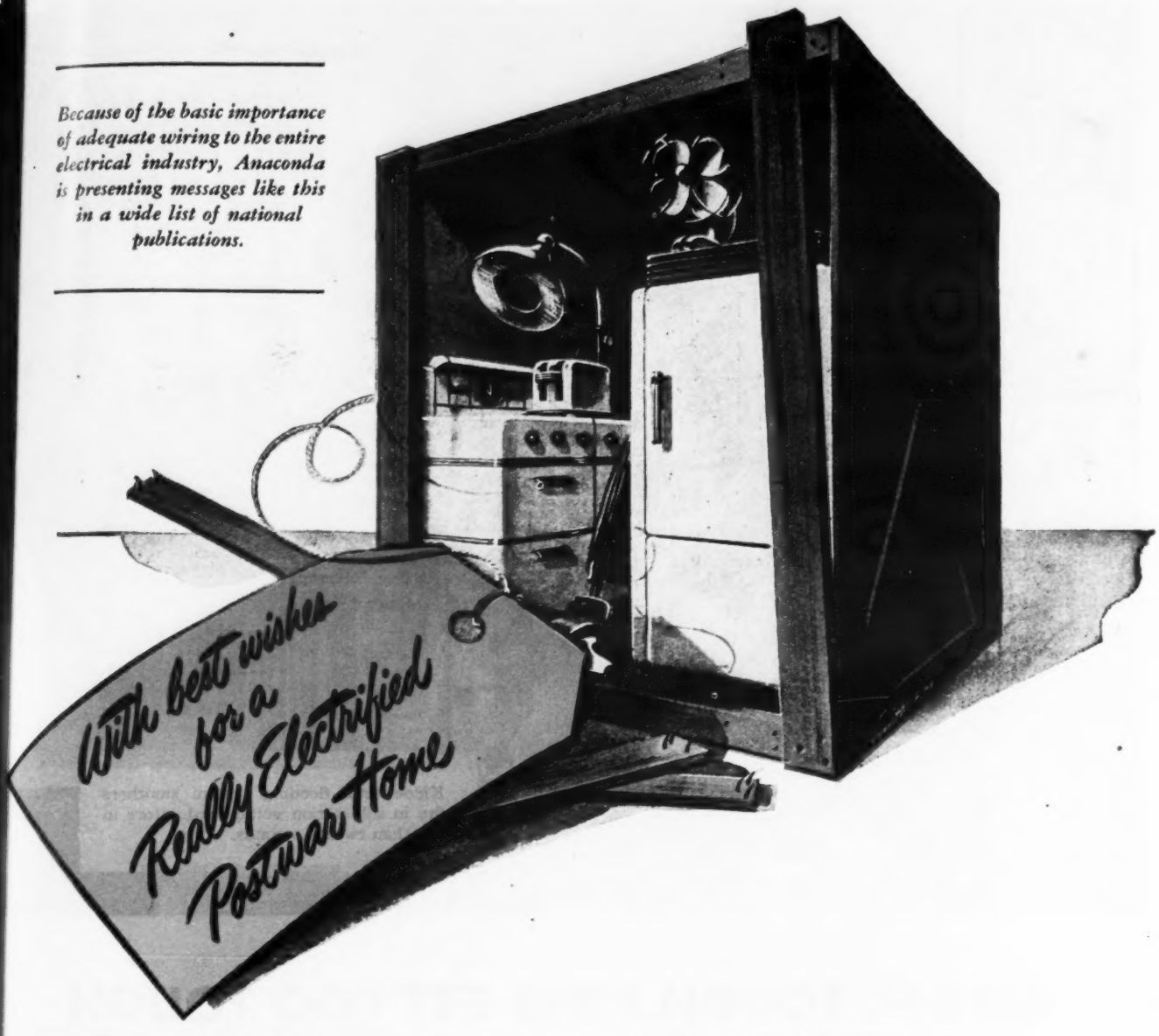
For complete specifications on HYDENT connectors, available in all types and for all wire and cable sizes, write to Burndy Engineering Co., 107 Bruckner Boulevard, New York 54, N. Y.

IN CANADA: Canadian Line Materials, Limited, Toronto 13

Headquarters for CONNECTORS

Burndy

Because of the basic importance of adequate wiring to the entire electrical industry, Anaconda is presenting messages like this in a wide list of national publications.



There will be no finer postwar present than a home generously equipped with electrical servants—*provided* there is sufficient electrical capacity for efficient performance.

Don't take past electrical experience as a guide. The huge increases in electrical usage in the future are certain to surprise you. Plan *reserve* capacity now and avoid costly, troublesome alterations later.

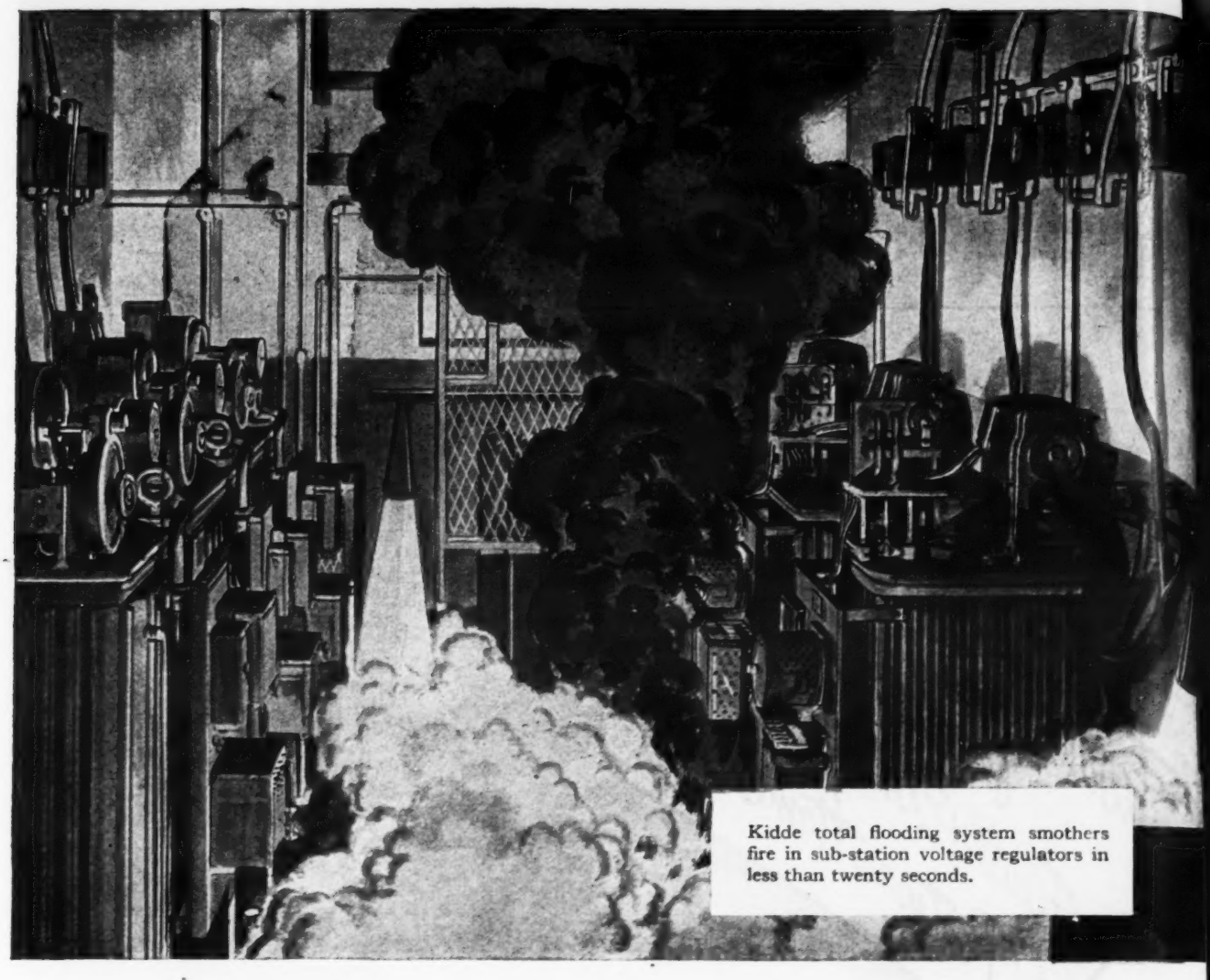
Industrial Plants! The same applies with equal weight to your electrical set-up. Why not talk it over now with your electrical contractor, utility power engineer, plant power engineer. In home or plant, planned wiring will cost a lot less than unplanned wiring. It's always wiser to Wire Ahead! 44266

ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

It's Always Wiser to TELEGRAM WIRE TELEGRAM AHEAD



Kidde total flooding system smothers fire in sub-station voltage regulators in less than twenty seconds.

BEFORE TOUGH FIRES GET TOO TOUGH

...blast them out with Kidde!

The fires that break out in sub-stations are really tough to fight—but Kidde built-in systems bring them quickly under control by smothering them under a blanket of dry, inert, non-conducting carbon dioxide.

There's no damage to insulation or water-soaking of apparatus when you use Kidde equipment—it limits the loss to the point of rupture. Equipment is back in service with the minimum of interruption.

Generators and other rotating machinery, switchgear, condensers, regulators and other electrical apparatus are all protected with equal efficiency by Kidde equipment. Remember, too, that all laboratories approve Kidde equipment for fighting class B fires in flammable liquids as well as for class C electrical fires. Install Kidde equipment for the protection of such hazards as flammable liquid storage and oil reclamation rooms — to give *complete* protection throughout your plant. Call in a Kidde representative for advice on the selection of equipment for each tough-fire area in the accompanying list. Write today.

KIDDE KILLS TOUGH FIRES

- Generators
- Motors
- Condensers
- Converters
- Transformers
- Switchgear
- Lightning Arresters
- Rectifiers
- Regulators
- Flammable Liquid Storage
- Filter Recirculation

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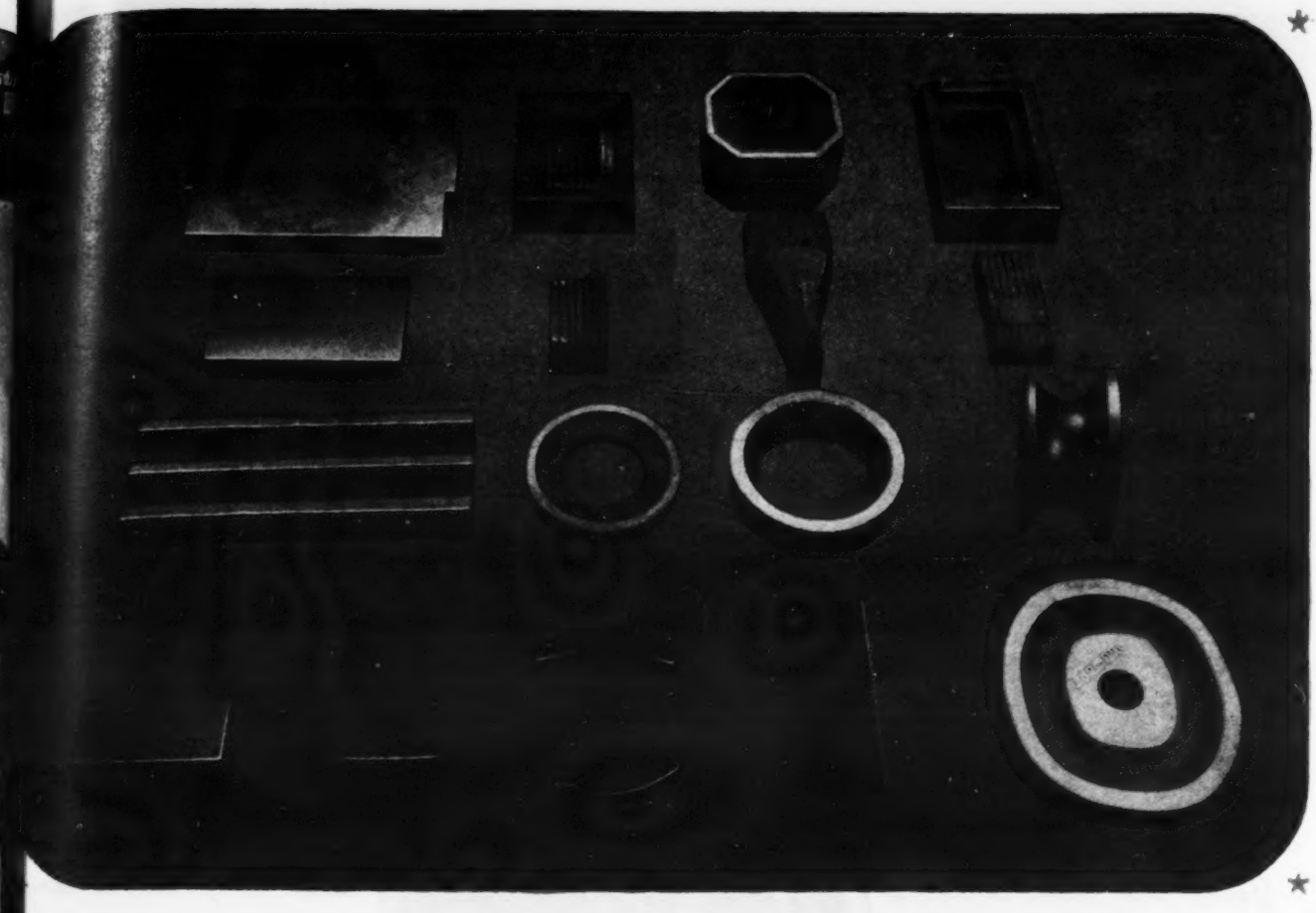

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WHEN it's dies you're making —small or large—or various other forming tools or gages or certain fast-wearing parts of machines, FCC Tool Steel Cast To Shape can really save you money.

Very intricate shapes can now be cast in one piece within an eighth-inch of finished size. This means that you pay for less steel to begin with, and reduce machining time substantially.

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Prompt delivery under CMP.

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It contains details of FCC Tool Steels Cast To Shape and of other important Forging and Casting Division specialties that may offer you money-saving production ideas. Get your copy—write for it today.

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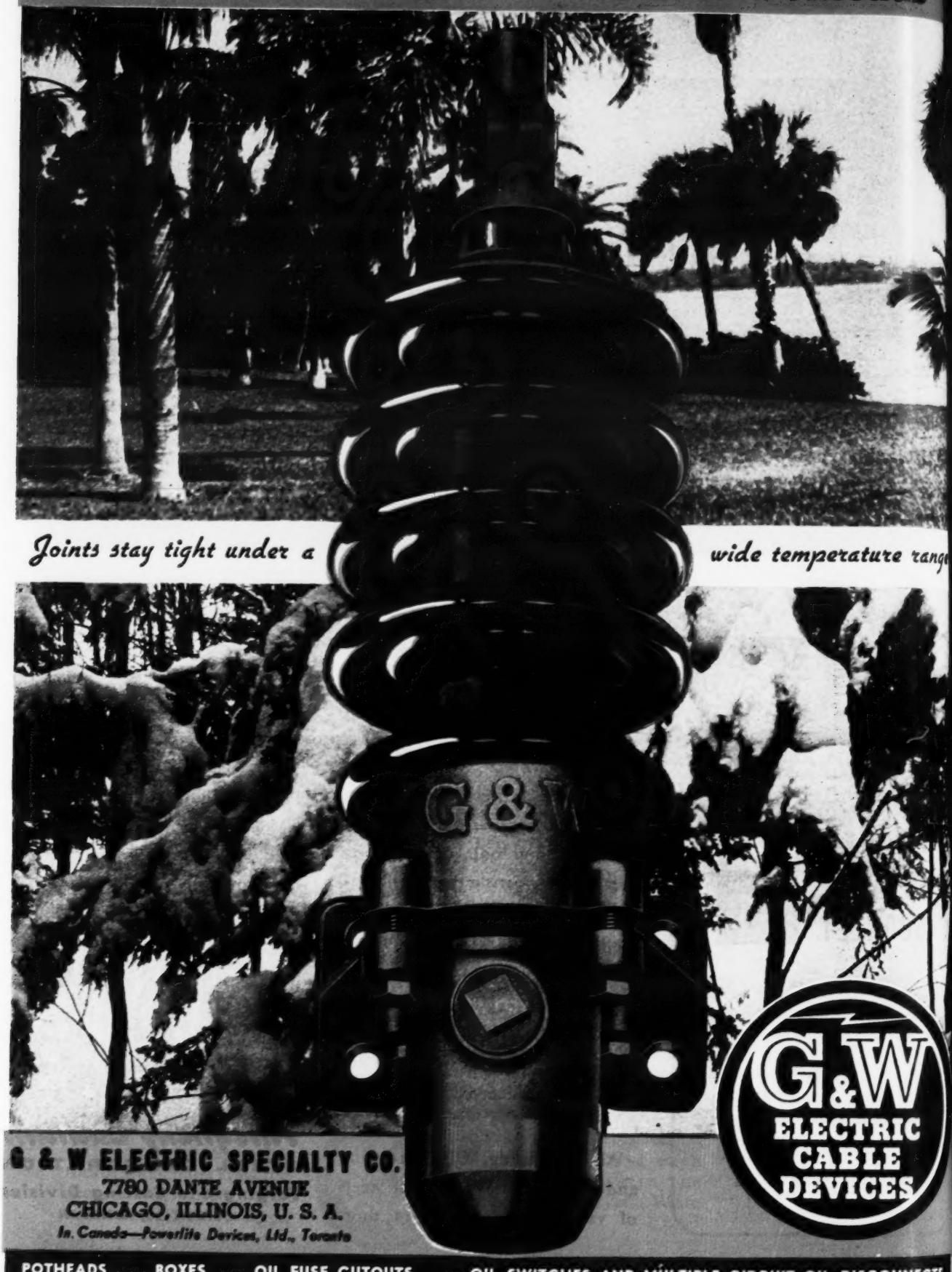
TO PROTECT YOUR CABLES AGAINST MOISTURE *Use G & W Potheads*



Joints stay tight under a wide temperature range

G & W ELECTRIC SPECIALTY CO.
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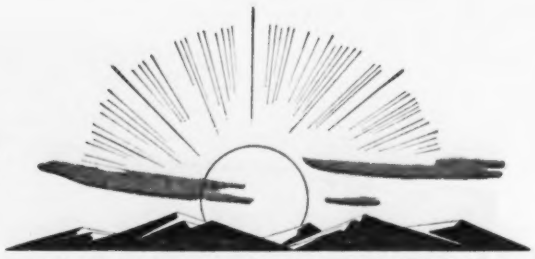
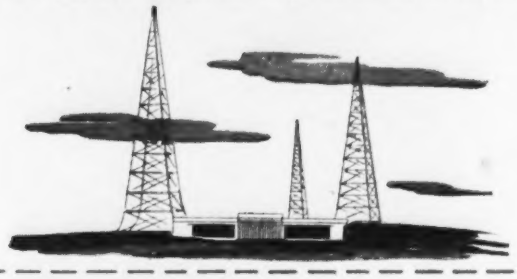
G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

A Great Electronic Day...

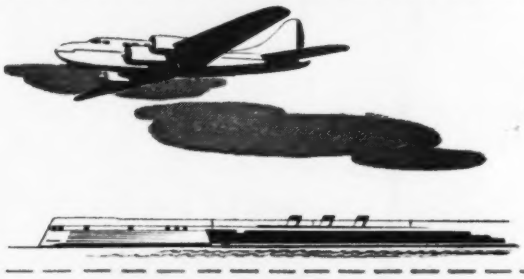


for Communications

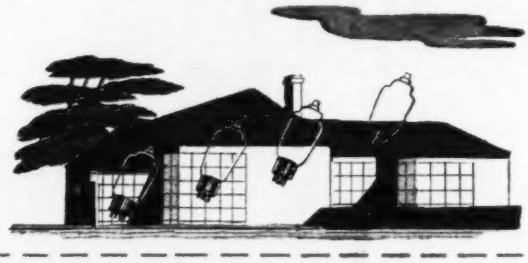


for Industry

for Transportation



for Home



Raytheon is proud of its contributions in the development of new electronic tubes and complete electronic equipment for the Armed Forces. Proud of the trust the military has placed in our designs, engineering and manufacturing abilities.

When war ends, Raytheon's wartime experience, research facilities, engineering and the production skills of over 16,000 men and women will be turned to peacetime electronics. Then you'll hear about and see Raytheon Electronic Equipment that will provide untold benefits in all phases of electronics. In the coming Age of Electronics . . . LOOK to Raytheon for complete electronic equipment and electronic tubes.

Tune in the Raytheon radio program: "MEET YOUR NAVY," every Saturday night on the entire Blue Network. Consult your local newspaper for time and station.

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Devoted to research and manufacture of complete electronic equipment; receiving, transmitting and hearing aid tubes; transformers; and voltage stabilizers.

G-279-T

Victory Will Mean
NEW JOBS *for* STEAM

Steam will blow the whistles when the big news comes. But, in heralding the great day, steam will have done far more than sound the signal for rejoicing.

Beyond steam's part in victory . . . beyond its record of powering ships, trains, war plants, there will be thousands of stories of men . . . *engineers* . . . men with trigger minds instead of trigger fingers . . . who tackled power plant problems with keen resourcefulness so that power for war needs would never be "too little or too late". With the end of hostilities will come new Victory jobs for steam . . . new problems . . . keener competition that will put emphasis on operating costs.

With today's accelerated experience yielding more complete answers to such problems as behavior of metals at high temperatures, action of fuels in slag-tap and dry-ash furnaces, circulation in high-capacity high-pressure boilers, separation of steam from water in boiler steam drums, and other related problems, the boilers of tomorrow will be even better able to serve industry.

Building boiler units complete with all essential components . . . controlling both the design and the application of the equipment fabricated . . . these, plus extensive facilities, give us at B&W a background that's unique. As a result our engineers have at their disposal an array of boilers from which to meet any combination of conditions of capacity, pressure, temperature, feedwater, fuel, and space. Now is a good time to consult with us regarding your steam plant requirements for the future.

6419

Army-Navy "E" flags have been awarded to five B&W plants, and also the Maritime Commission Award flags to the Barberton, Ohio, Plant.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
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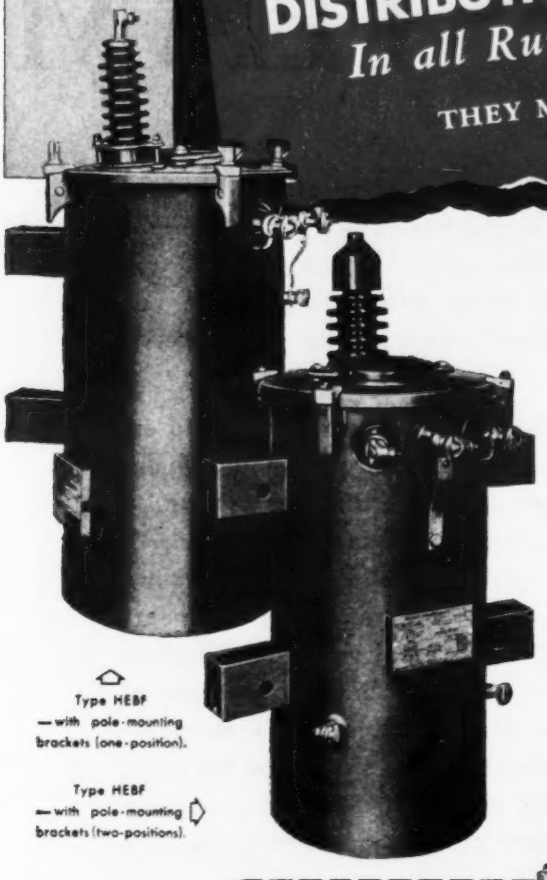
Include

Wagner

DISTRIBUTION TRANSFORMERS

In all Rural-Line Installations

THEY MEET ALL STANDARDS



Type HEBF
—with pole-mounting brackets (one-position).

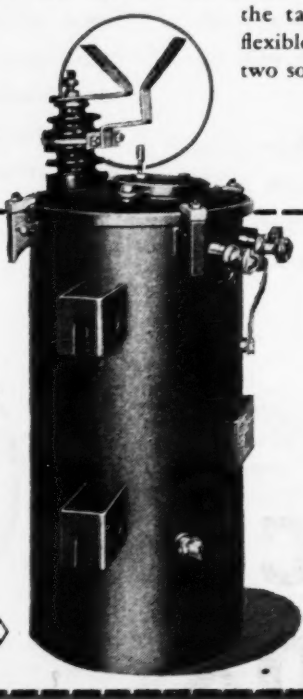
Type HEBF
—with pole-mounting brackets (two-positions).

Wagner rural-line distribution transformers, designed to meet all accepted standards, are available in sizes 1-½ to 25-kva for use on 12,470 Grd. Y/7200 and 13,200 Grd. Y/7620 volts, 60-cycle lines with low-voltage ratings of 120/240 volts.

The high standard of quality and performance of all Wagner rural-line transformers is basically the result of improved design and construction of the core and coils which are really the heart of any transformer. Wagner core and coils are fabricated from carefully selected and pre-tested materials and are thoroughly tested for the exacting performance required on rural-line operation.

The high-voltage windings are provided with one high-voltage, wet-process porcelain bushing in the cover. The other end is permanently connected internally to the tank. Three low-voltage bushings are brought out through the tank wall. The low-voltage windings are suitable for two- or three-wire service. The low-voltage neutral may be grounded to the tank through an external ground-strap of flexible braided copper. The tank is provided with two solderless ground connectors.

Write for Complete Information

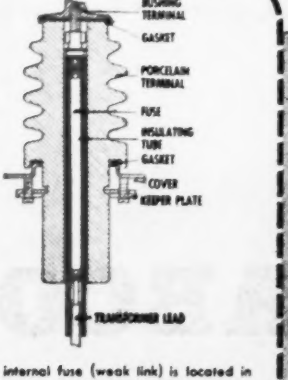


PROTECTIVE ACCESSORIES

available for conventional type Rural-Line Transformers.

No other surge protection or transformer fuses are required when a double "bird-proof" gap and internal fuse (weak link) are combined. The internal fuse provides a protective link between the transformer and the high-voltage line, and the double gap provides surge protection. The conventional type transformers are available with these accessories.

The double "bird-proof" gap is located on the high-voltage bushing.



T44-18

The internal fuse (weak link) is located in the high-voltage bushing between the high-voltage terminal and the primary-coil lead.

ARMY E NAVY

Wagner Electric Corporation

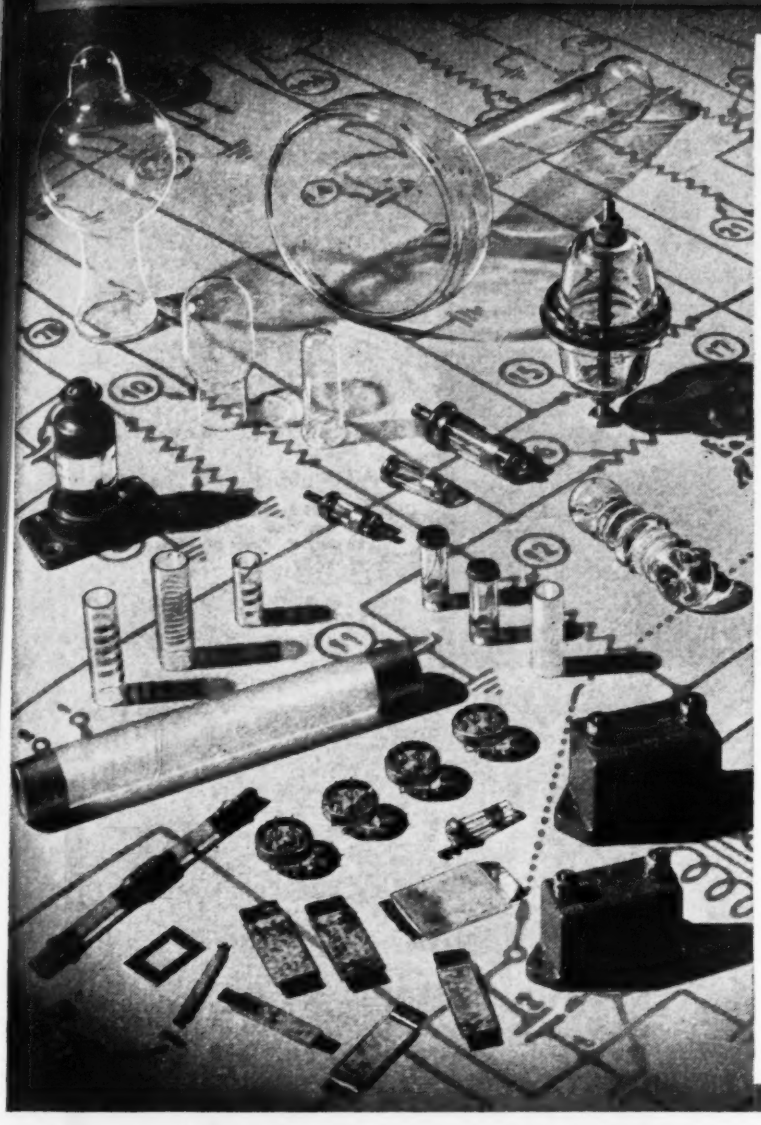
ESTABLISHED 1891

6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

WHAT WILL YOU NEED TO PRODUCE BETTER POST-WAR PRODUCTS?

CORNING GLASS GIVES YOU



Special Electrical Qualities
Thermal Endurance
Hermetic Sealing
Mechanical Strength
Corrosion Resistance
Precision
Permanence
Metallizing
Dimensional Stability

High dielectric strength — high resistivity—low power factor—wide range of dielectric constants—low losses at all frequencies.

Permanent hermetic seals against gas, oil and water readily made between glass and metal or glass and glass.

Commercial fabrication to the fine tolerances of precision metal working.

Corning's metallizing process produces metal areas of fixed and exact specification, permanently bonded to glass.

AS YOU plan post-war electronic products, give a thought to versatile glass. We really mean glasses, for Corning has, at its fingertips, 25,000 different glass formulae from which to select those especially suited to your electronic applications. Let us show what glass can do for you. We may already have a solution — or Corning Research can find the answer for you. Address Electronic Sales Dept., W-12, Bulb and Tubing Division. Corning Glass Works, Corning, New York.

CORNING *means* Research in Glass

Electronic Glassware

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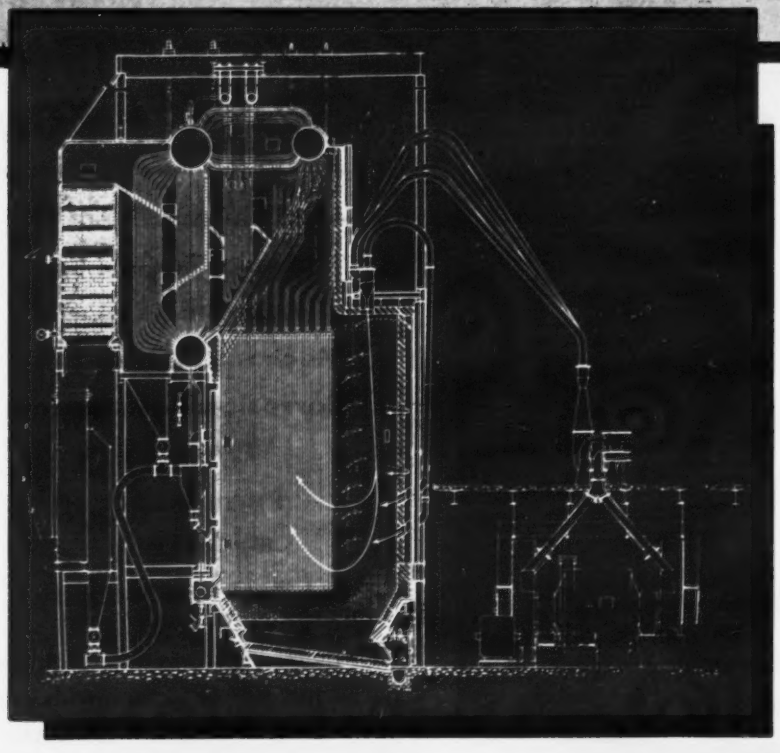
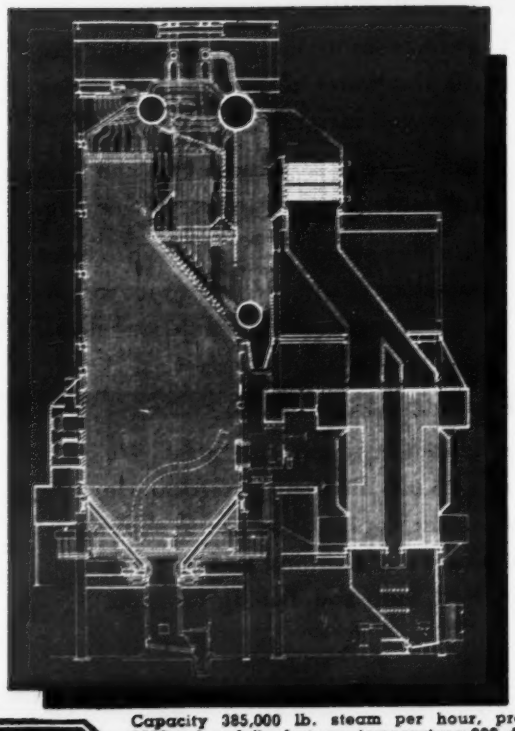
STEAM GENERATORS

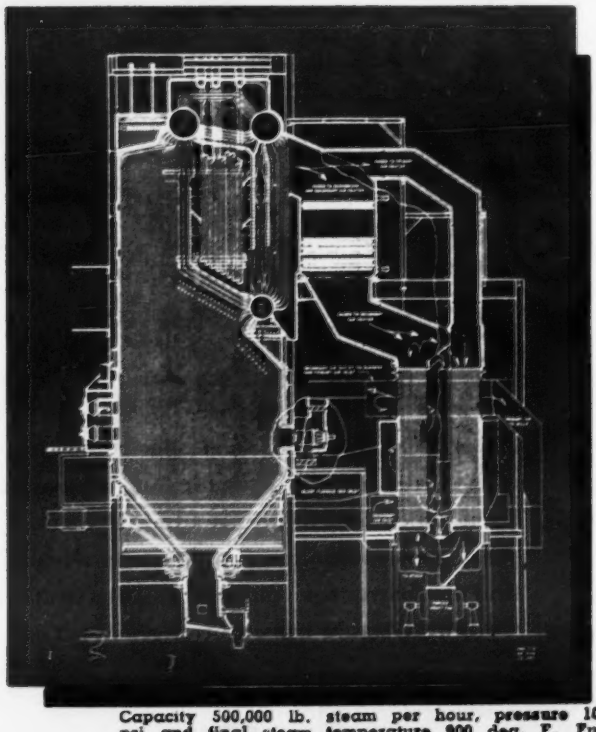
CAPACITIES



Capacity 165,375 lb. steam per hour, pressure 900 psi and final steam temperature 788 deg. F. Fuel: pulverized coal.



Capacity 385,000 lb. steam per hour, pressure 1050 psi and final steam temperature 900 deg. F. Fuel: pulverized coal and blast furnace gas.



Capacity 500,000 lb. steam per hour, pressure 1050 psi and final steam temperature 900 deg. F. Fuel: pulverized coal and blast furnace gas.

FW **FOSTER**

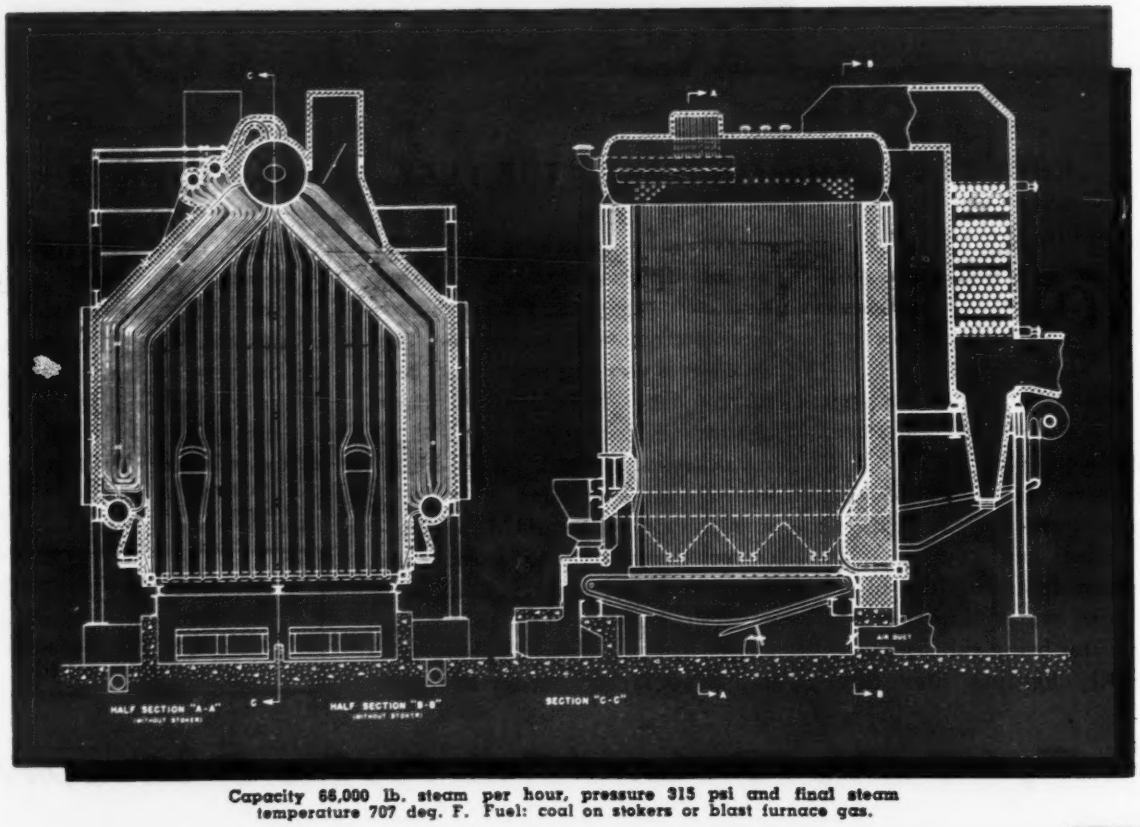
FOR RUSSIA ...

66,000 TO 500,000 LB. STEAM PER HOUR

THE steam generators shown in the accompanying drawings represent 23 of the many boilers that Foster Wheeler has designed and built for Russia during the past two years.

Their capacities range from 66,000 to 500,000 lb. steam per hour with pressures from 315 psi to 1050 psi and final steam temperatures from 707 deg. F. to 900 deg. F. To accommodate the variety of fuels available, these units are designed for stoker, pulverized coal and blast furnace gas firing.

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.

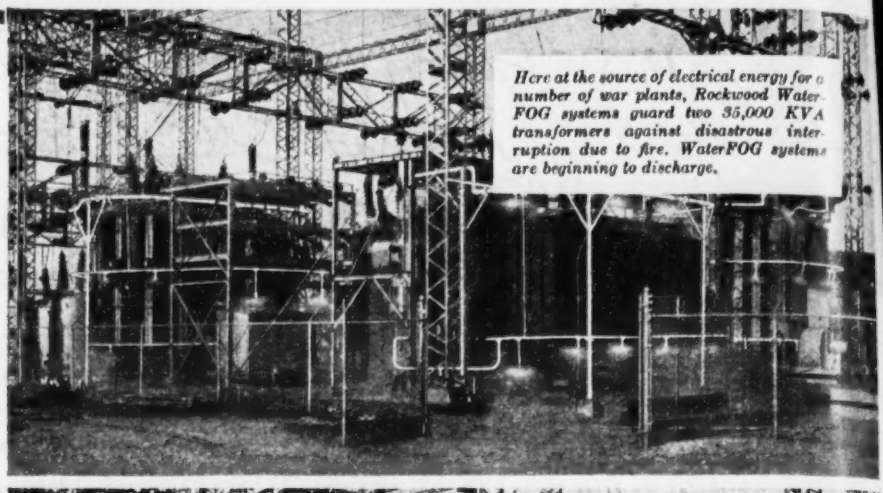


Capacity 66,000 lb. steam per hour, pressure 315 psi and final steam temperature 707 deg. F. Fuel: coal on stokers or blast furnace gas.

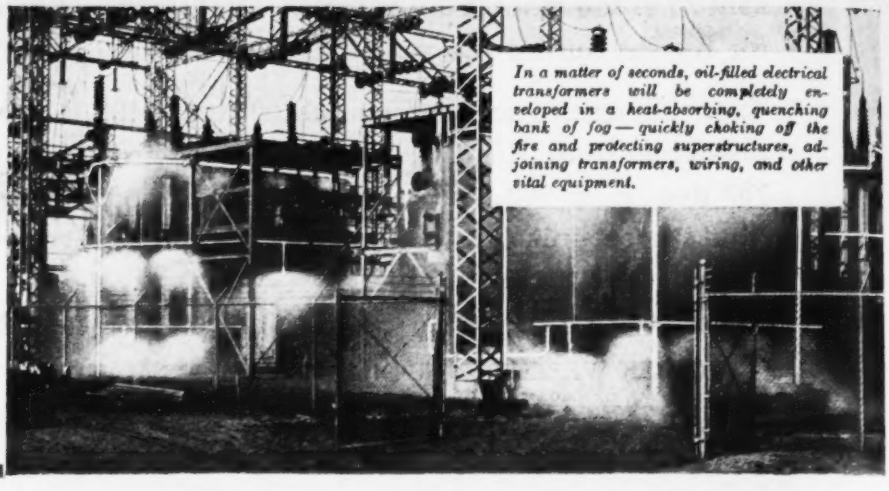
WHEELER

WaterFOG

Shields The Heart Of A War-Working Community



Here at the source of electrical energy for a number of war plants, Rockwood WaterFOG systems guard two 35,000 KVA transformers against disastrous interruption due to fire. WaterFOG systems are beginning to discharge.



In a matter of seconds, oil-filled electrical transformers will be completely enveloped in a heat-absorbing, quenching bank of fog — quickly choking off the fire and protecting superstructures, adjoining transformers, wiring, and other vital equipment.

ROCKWOOD WaterFOG TAKES THE FURY OUT OF OIL FIRES

Now water . . . cheap, plentiful . . . becomes your *surest* means of protecting against fires in flammable liquids — whether in transformers or open tanks.

WaterFOG is safe to use on such fires . . . and completely effective. Its tiny water particles are so highly heat-absorptive (in direct proportion to their fineness) that the fire is rapidly cooled and confined. No splashing and spreading the blaze. No excessive water damage. No danger of water being exhausted.

WaterFOG, fighting fires three ways . . . by quenching the flames, by retarding vaporization, by shutting off oxygen . . . gives you complete protection at lowest cost. And — what is very important — it cools surrounding structures to guard against "flash-back"

Rockwood WaterFOG is created by impinging streams of water at scientifically-determined angles — correctly engineered for particle size, fog pattern, and velocity. Rockwood-engineered fixed installations approved by Underwriters' Laboratories and Associated Factory Mutuals.

Nozzles and applicators for fire hose lines also available. Colored movies (16 mm.) showing tests of Rockwood WaterFOG are available to business executives. Write for Bulletin 123.

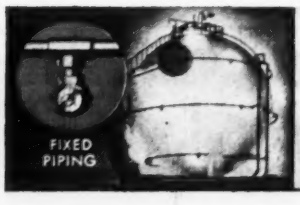
ROCKWOOD SPRINKLER COMPANY
62 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

TYPICAL WaterFOG APPLICATIONS ARE:

transformers	generators
oil switches	paint shops
control rooms	oil storage, etc.

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires

ROCKWOOD WaterFOG



THE MOST DESIRABLE CHARACTERISTICS OF ALL GOOD SWITCHES ARE INHERENT IN THE "MK-39"

CONSIDER THESE FEATURES

1. Positively controlled blade motion – no stops or gadgets – fast or slow shock proof action – simplified control eliminates conventional crank arms. Blade automatically locks in both open and closed position.
2. High pressure contacts at both ends of blade – no flexible shunts and consequent corrosion troubles.
3. Greasless non-rusting ball bearings on all essential rotating parts.
4. Operating mechanism furnished with threadless fittings equipped with self piecing set screws, preventing slipping, after simple adjustments are made.

YOUR SYSTEM DESERVES THE BEST — YOU CAN GET IT AT NO GREATER COST

It will pay you to include the "MK-39" in your post-war modernization program. Ask for publication No. 4109-A – or better still call our nearest district office for details.

Available in all standard voltage ratings (thru 230-kv) and all ampere ratings (thru 6,000) for upright, inverted or vertical mounting.

DELTA-STAR ELECTRIC COMPANY

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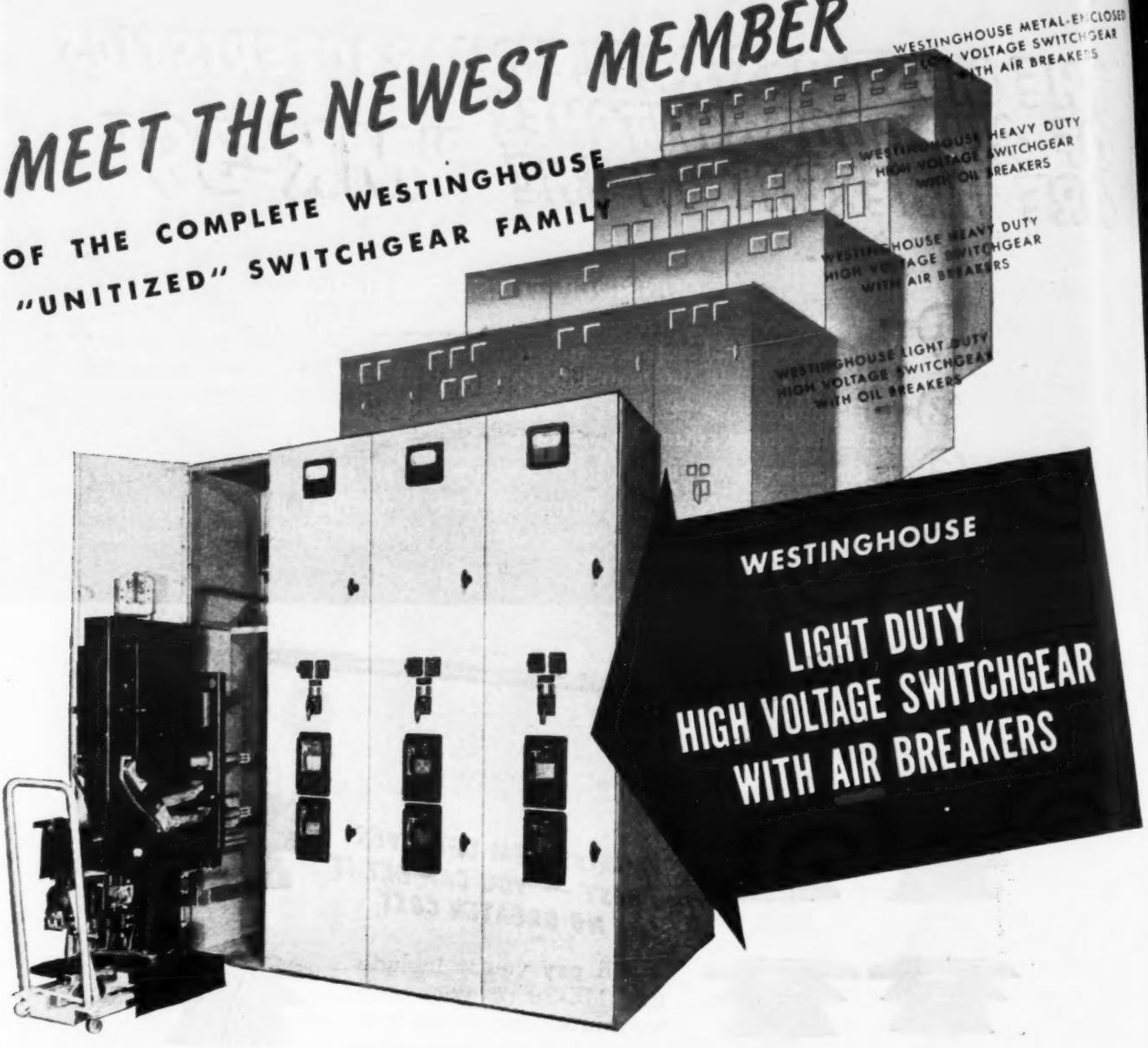
CANADIAN ASSOCIATE

Canadian Line Materials Limited ..... Toronto 13, Canada

MEET THE NEWEST MEMBER

OF THE COMPLETE WESTINGHOUSE "UNITIZED" SWITCHGEAR FAMILY


WESTINGHOUSE METAL-ENCLOSED VOLTAGE SWITCHGEAR TH AIR BREAKERS
WESTINGHOUSE HEAVY DUTY HIGH VOLTAGE SWITCHGEAR WITH OIL BREAKERS
WESTINGHOUSE HEAVY DUTY HIGH VOLTAGE SWITCHGEAR WITH AIR BREAKERS
WESTINGHOUSE LIGHT DUTY HIGH VOLTAGE SWITCHGEAR WITH OIL BREAKERS
WESTINGHOUSE
LIGHT DUTY
HIGH VOLTAGE SWITCHGEAR
WITH AIR BREAKERS

Newest member of the Westinghouse "Unitized" switchgear family is the 50,000 kv-a Type DHM Switchgear (a ***high voltage*** unit with *air* breakers, for light duty).

SPECIFY IT for circuits up to 5000 volts, 600 and 1200 amperes. Interrupting capacity is 50,000 kv-a.

APPLY IT for switching equipment on main and auxiliary circuits of central stations, steel mills, industrial plants, distribution substations, customers' substations in office buildings.

INSTALL where reduction in floor space and height are important . . . where time and cost saved in installation is a consideration . . . where this rating and design are electrically and economically right!

New air circuit breakers make possible this new design. Type 50-DH-50 Breakers are completely self-contained, operate in normal atmosphere and require no external air under pressure. Get the story on this new Westinghouse switchgear—write for D.D. 32-130. Westinghouse Electric & Manufacturing Company, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-60562

ALL WESTINGHOUSE "UNITIZED" SWITCHGEAR OFFERS THESE FIVE MAJOR ADVANTAGES

1. QUICKER ORDERING, ASSEMBLY, SHIPMENT. 2. IMPROVED SERVICE CONTINUITY. 3. COMPLETE OPERATING SAFETY. 4. EASY ACCESSIBILITY. 5. ADVANCED MANUFACTURING AND DESIGN FEATURES.

Westinghouse

PLANTS IN 25 CITIES.. OFFICES EVERYWHERE

"UNITIZED" SWITCHGEAR

Bulletin

TO ALL TRUCK OPERATORS AND FLEET OWNERS

Trucks Available for Civilian chase on and after Jan. 1, 1945

OOD NEWS—FWD four-wheel-drive trucks, e-eminent in war services, with production eviously restricted almost exclusively for the ilitary, are soon to be available for motor transport, highway, utility, oil fields, and other essential civilian services.

Recent directive from the WPB provides for production of a substantial number of FWD trucks in a wide variety of models and types, 2½ to 15 tons capacity; such trucks to be built only for essential civilian uses. FWD trucks built under this release will be available for purchase on and after January 1, 1945. Deliveries will be made in keeping with priority of orders as received; immediate action and prompt placing of orders is urgent to assure delivery before limit of production is reached.

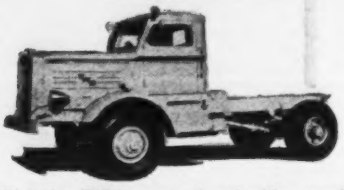
Write — wire — or phone us directly, or the nearest authorized FWD dealer for full information and your eligibility to purchase under these new rationing regulations.

FWD TRUCKS

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONTARIO

These and other FWD Trucks, 2½ to 15 ton capacity, available to qualified purchasers.

Straight trucks in FWD's "H" series range 17,000 to 20,000 lbs. gross vehicle weight capacity with wheelbases from 144" to 154" gasoline engine powered with power plants from 100 to 120 hp and with four-wheel drive.



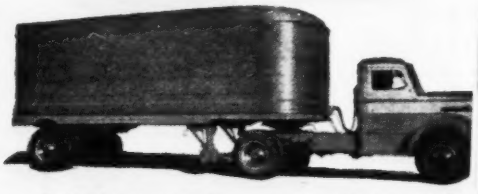
"M" series FWD's powered with either gasoline or diesel engines ranging from 150 to 200 hp and with capacities ranging from 30,000 to 42,000 lbs. gross vehicle weight. Four wheel drive.

"U" series FWD's with gross vehicle weight capacities of 22,000 to 28,000 lbs. Powered with 125 hp gasoline engines, 5 speed transmission, 11:00x20 tires, wheelbase 150". Four wheel drive.

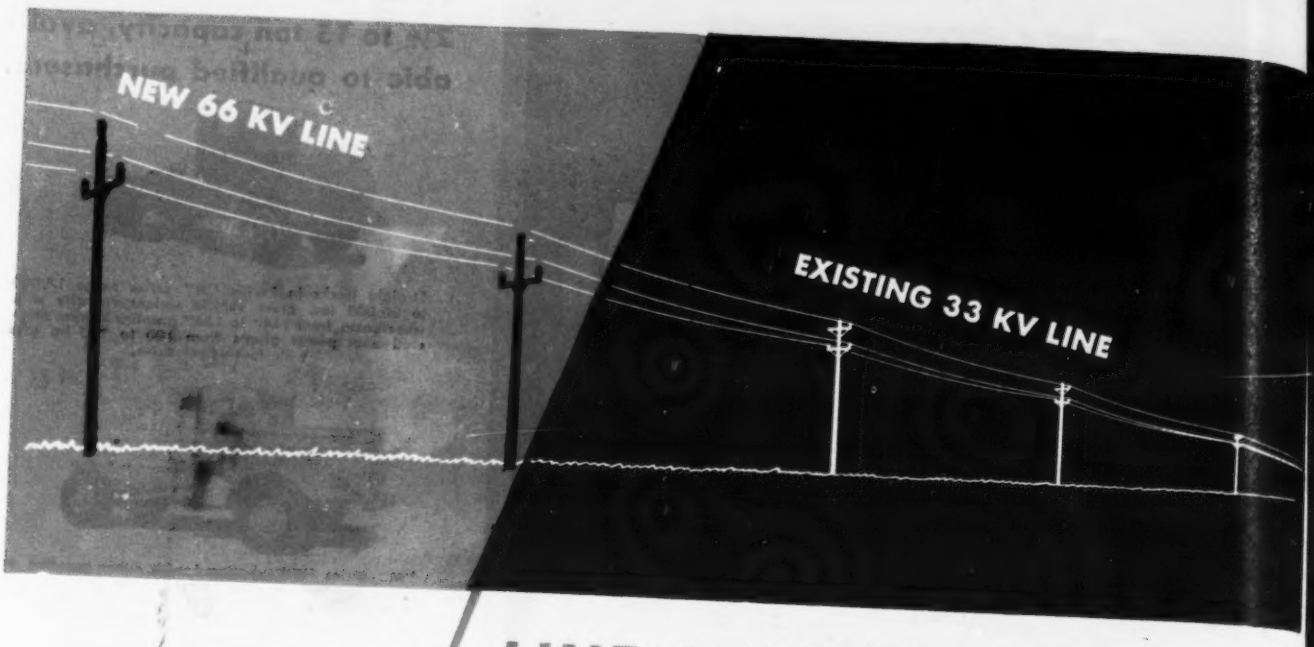
FWD's four-wheel drive Road Maintainer — built for underbody scraper use with extra heavy frame and other features that make it the ideal unit for street and road maintenance. Engine 115 hp — 5 speed transmission — 8:25x20 dual tires.

Utility Line Construction and Maintenance trucks by FWD with 5 and 7 man cabs, special power-take-offs and line bodies. Powered with 115 hp engine on 144" wheelbase with four-wheel drive, 5 speed transmission, 144" wheelbase and 9:00x20 tires.

Six-wheel drive FWD trucks with gross vehicle weight capacities of 55,000 lbs. Powered with either gasoline or diesel engines of 150 and 200 hp. Wheelbase from 214½" to 276".



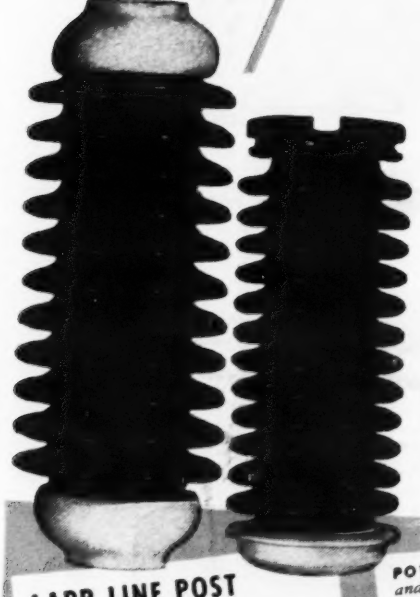
FWD's "H" series tractor trucks with four-wheel drive and gross vehicle weight ratings from 40,000 lbs. to 60,000 lbs. Powered with gasoline engines ranging from 100 to 120 hp on wheelbases from 120" to 144" in conventional or cab-over-engine types.



LINE CONVERSION WITH LAPP LINE POSTS

is the fastest way to fortify your system.... and uses least materials

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

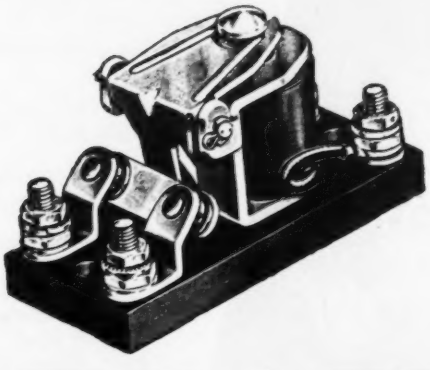
MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

STRUTHERS-DUNN
INC.

~~5,288~~ 5,312
TYPES OF



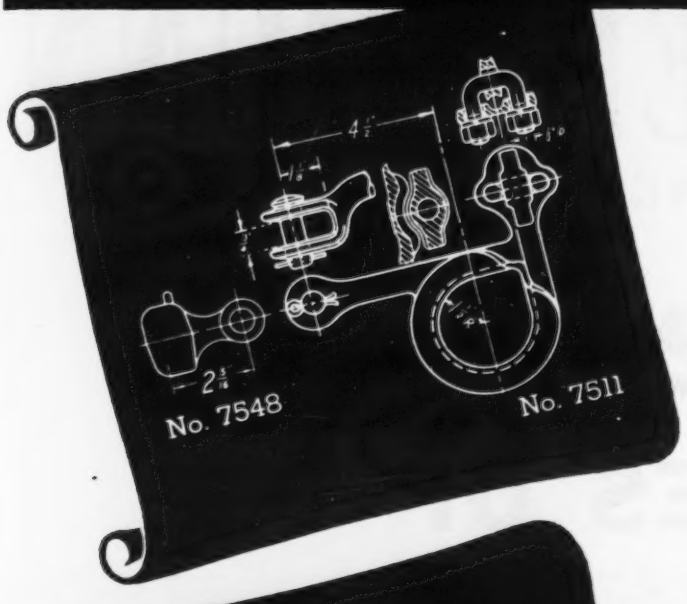
RELAYS

Each available in countless coil combinations

1321 ARCH STREET, PHILADELPHIA 7, PA.

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DALLAS • DENVER • DETROIT • HARTFORD • INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL
NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

Rural & Light Tran



These are the familiar and accepted snubbing type, designed for dead-ending the lighter duty transmission and distribution lines. Low in price, they are especially adapted to rural electrification and light transmission work.

The use of forged steel parts results in a light-weight clamp with more than adequate strength. This feature, together with the short connection length, protect the conductor from the possible effect of vibration.

The ample radius of snub, smooth cable seat and long clamping keeper prevent damage to the conductor and the side opening type is easy to install and work with hot-line tools. Reversible two-groove keepers accommodate a wide range of conductor sizes.

No. 7511 (without fitting). No. 7548 (with socket eye).
For all conductors within its size range.
Min. 0.16—Max. 0.55.

Not recommended for A. C. S. R. conductors larger than No. 2-0 due to their stiffness.

Ultimate strength 10,000 lbs. Shpg. wgt. 280 lbs. per C.

No. 2104 (without fitting). No. 21048 (with socket eye).
For all conductors within its size range.
Min. 0.187—Max. 0.50.

Ultimate strength 9,000 lbs. Shpg. wgt. 200 lbs. per C.

No. 2102 (without fitting). No. 21028 (with socket).
For all conductors except A. C. S. R. within its size range.
Min. 0.128—Max. 0.375.

Ideal for the popular A series Copperweld-copper or other similar three-strand composite conductors.

Ultimate strength 7000 lbs. Shpg. wgt. 145 lbs. per C.

BTC HI-LIN

THE BREWER-TITCHENER CORPORATION

...ission Line Clamps

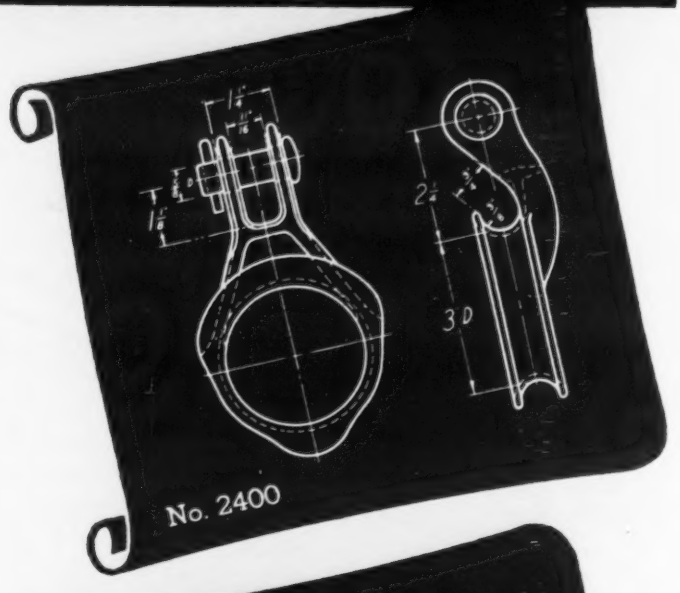
SIDE OPENING CLEVIS THIMBLE

For Angle and Strain Position
No. 2400

Suitable for all conductors generally used on Rural and Light duty transmission and distribution lines.

Note provision for the tie winds at each side of the lower part of the thimble. May also be used as a dead end thimble. Very light in weight with more than adequate strength. Side opening allows easy installation.

Ultimate strength 9,000 lbs. Shpg. wgt. 120 lbs. per C.



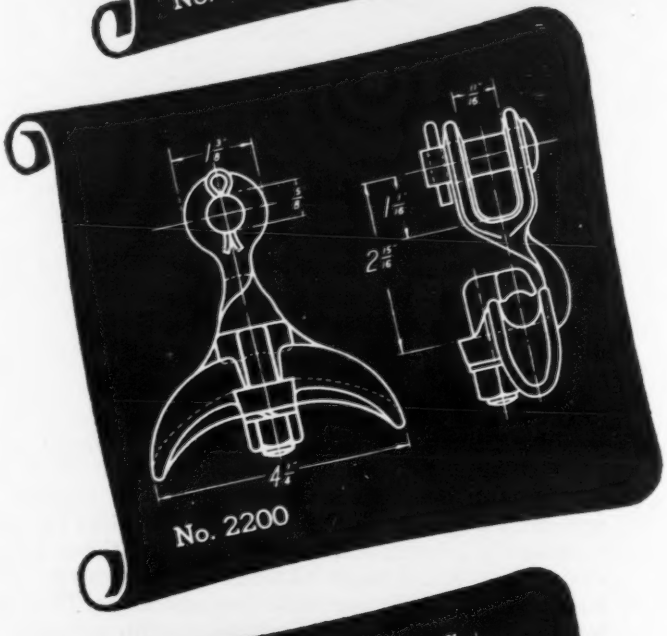
ANGLE CLAMPS

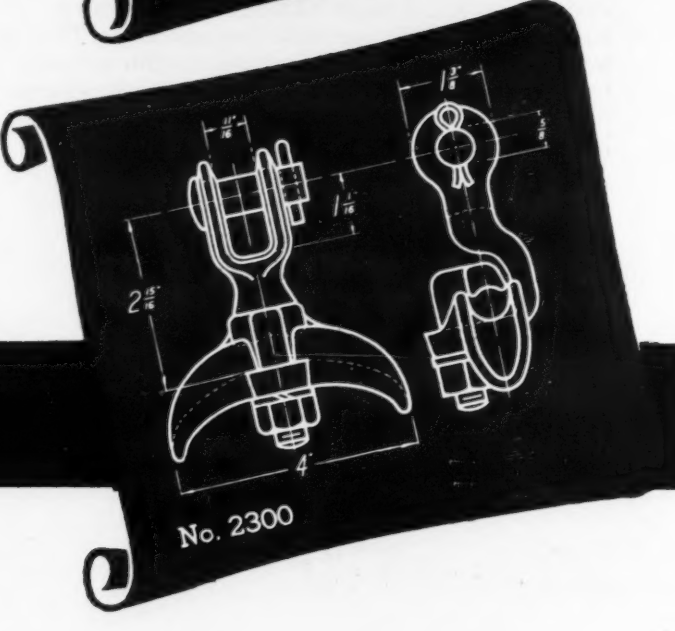
Nos. 2200 and 2300

Especially designed for construction having angles of 30 degrees to 120 degrees. Suitable for all commercial sizes of conductors from .12 to .60 diameter, including armor rod or ribbon.

The three inch seat contour radius meets the requirements for A. C. S. R.—Copper, Copperweld, Copper Composite and other conductors. Side opening—easy to install or work with hot-line tools. Unnecessary to remove the T-Bolt keeper during installation.

Shpg. wgt. 145 lbs. per C. Ultimate strength 5,000 lbs.





ARMY E NAVY

AWARDED TO CORTLAND FORGING DIVISION

HARDWARE

CORTLAND, NEW YORK

PANELYTE*

OFFERS YOU EXPERT COUNSEL

in your own locality

You do not have to "limit your call to 5 minutes." Our sales engineers are at *your* service . . . ready to supply authoritative advice on the use of structural, laminated plastics. The network of strategically located Sales Offices was established to supply any required information *promptly*.

Whether it is a matter of specifying the correct thermo-setting plastic . . . a design problem . . . a structural or insulating application . . . or a question on mass-production facilities for molded or fabricated parts . . . check with the PANELYTE representative in *your* locality. Not only do these experienced men know what PANELYTE Plastics *can* do . . . but equally as important what they *cannot* do. They are also familiar with specific applications in your industry. To save time, consult the PANELYTE Office nearest you on any problem involving the immediate or postwar use of thermo-setting laminated materials.

Atlanta
177 Harris St., N.W.
Atlanta 3, Georgia
Boston
1137 Park Square Bldg.
Boston 16, Mass.
Chicago
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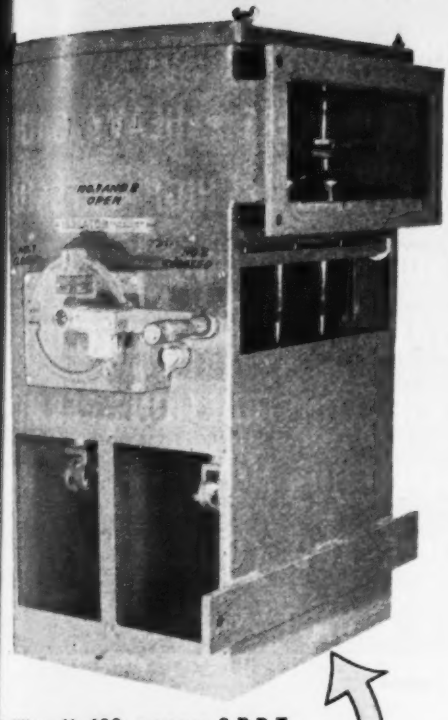
Chicago 1, Illinois
Cincinnati
1615-16 Carew Tower
Cincinnati 2, Ohio
Cleveland
813 Union Commerce Bldg.
Cleveland 14, Ohio
Dallas
825 Trunk Avenue
Dallas, Texas
Denver
Speer Blvd. at Lincoln St.
Denver, Colorado
Detroit
419 Boulevard Bldg.
Woodward at Grand Blvd.
Detroit 2, Michigan
Kansas City
901 Fidelity Bldg.
Kansas City 6, Mo.
Los Angeles
418 East Third Street
Los Angeles 13, Calif.
Mexico City
Ave. Madero No. 1, Desp. 314
Mexico, D. F.
Montreal
132 St. James St., W.
Montreal, Canada
New Orleans
918 Union Street
New Orleans, La.
Phoenix
Phoenix, Arizona
St. Louis
3980 Bowen Street
St. Louis, Missouri
St. Paul
2645 University Ave.
St. Paul 4, Minnesota
San Francisco
316 Eleventh Street
San Francisco 3, Calif.
Seattle
2406 First Avenue
Seattle 1, Washington
Syracuse
State Tower Bldg.
Syracuse 2, New York
Toronto
137 Wellington Street, W
Toronto, Canada
Trenton
Enterprise Avenue
Trenton 4, New Jersey
Vancouver
841 West Broadway
Vancouver, B. C.

PANELYTE — *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES

INTERRUPT HIGH VOLTAGE POWER CIRCUITS ··· THE MODERN *Streamlined* WAY



5 Kilovolt 400 ampere 3.P.D.T. Load Interrupter ISOLATOR

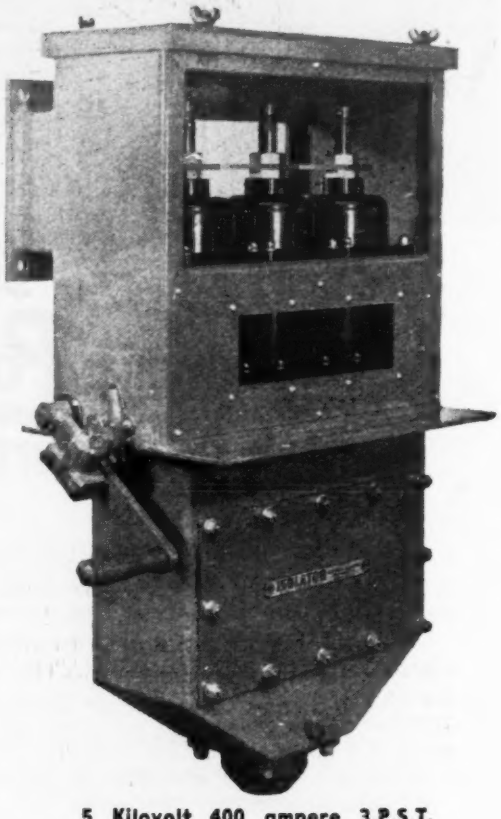
THE "THREE E" LOAD INTERRUPTER ISOLATOR incorporates all the advantages of the well known disconnect ISOLATOR, plus load interrupting ability.

It is the ideal device for interrupting substantial load currents and the magnetizing currents of transformers, regulators, cables, etc.

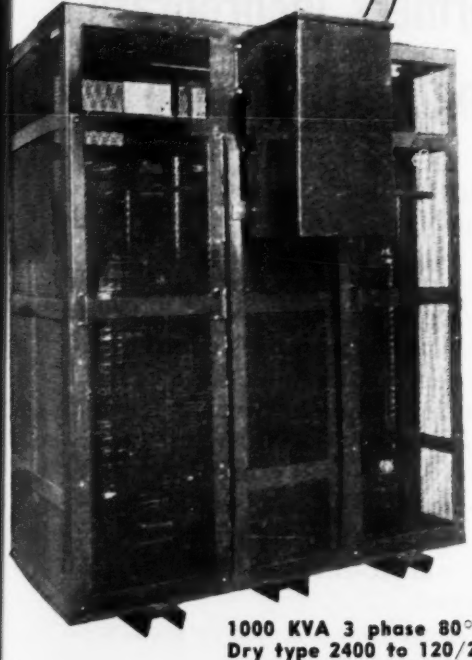
The Load Interrupter ISOLATOR has the following outstanding features.

- **Interruption takes place in air, within interrupter unit.**
- **It is light, compact, and simple.**
- **Does away with heavy complicated oil break equipment with its ever present FIRE HAZARD and MAINTENANCE EXPENSE.**
- **It is the only device of its kind on which the interrupter unit can be removed and replaced by an insulated stick.**
- **It is not necessary to de-energize circuit in order to remove or replace interrupter unit.**
- **Occupies minimum amount of space.**

MADE FOR VOLTAGES UP TO 15 KILOVOLT



5 Kilovolt 400 ampere 3.P.S.T. Load Interrupter CABLE ISOLATOR arranged for transformer mounting.



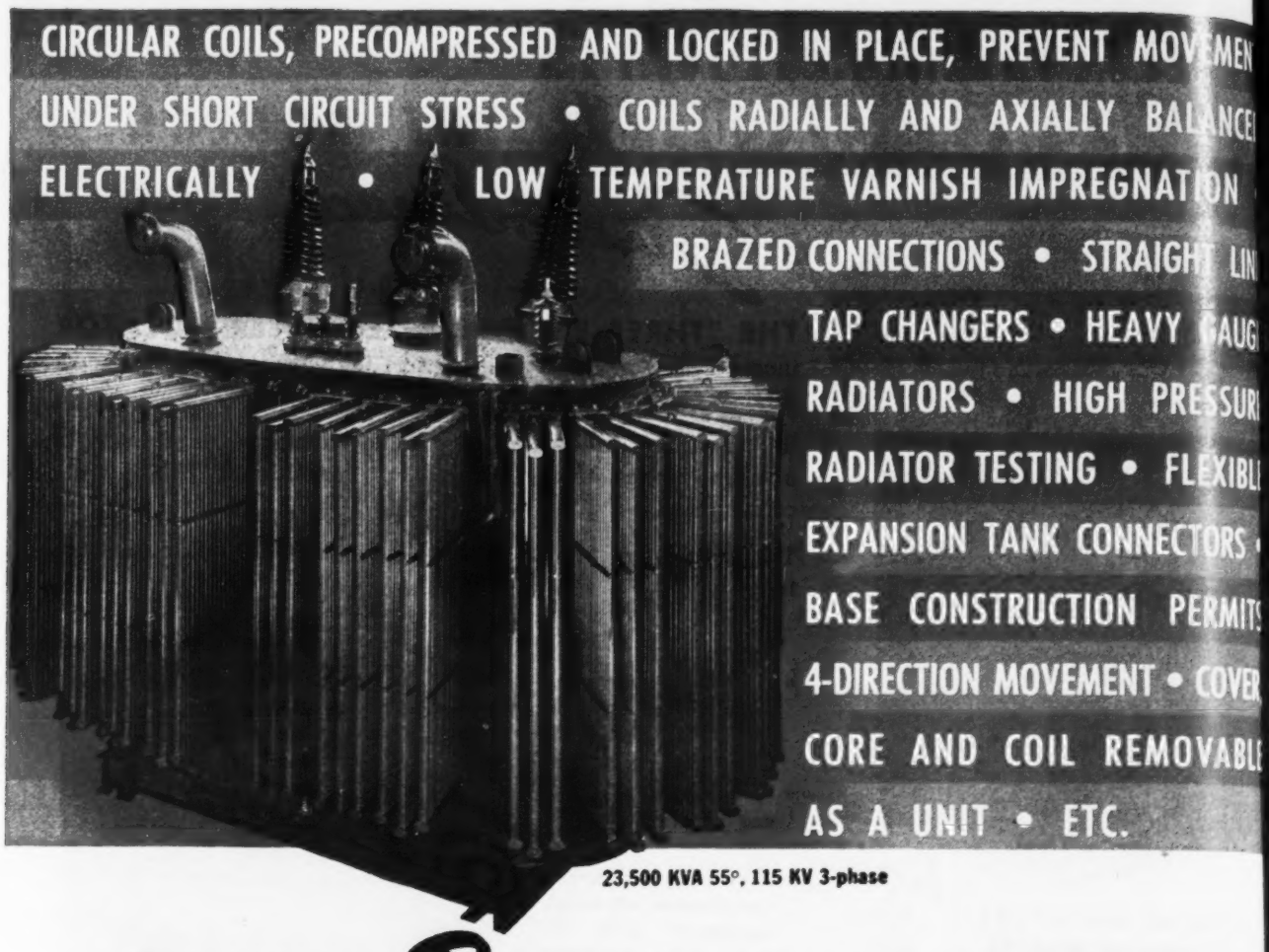
1000 KVA 3 phase 80° C. rise Dry type 2400 to 120/240 volts Moloney Electric Co. transformer equipped with Load Interrupter ISOLATOR

The "THREE E" Company will be glad to cooperate with your transformer manufacturer to see that your power transformer is equipped with the Load Interrupter ISOLATOR.

Send for Bulletin 138

THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS


CIRCULAR COILS, PRECOMPRESSED AND LOCKED IN PLACE, PREVENT MOVEMEN
UNDER SHORT CIRCUIT STRESS • COILS RADIALLY AND AXIALLY BALANCE
ELECTRICALLY • LOW TEMPERATURE VARNISH IMPREGNATION
BRAZED CONNECTIONS • STRAIGHT LIN
TAP CHANGERS • HEAVY GAUG
RADIATORS • HIGH PRESSUR
RADIATOR TESTING • FLEXIBL
EXPANSION TANK CONNECTORS
BASE CONSTRUCTION PERMIT
4-DIRECTION MOVEMENT • COVER
CORE AND COIL REMOVABL
AS A UNIT • ETC.

23,500 KVA 55°, 115 KV 3-phase

Pennsylvania Power Transformers incorporate all the factors for outstanding performance*

Feature by feature, Pennsylvania Power Transformers are equal to any and superior to many. But when you buy Power Transformers you are not buying individual features, specific gadgets or trimmings. You seek overall *performance** . . . resulting from a *combination* of *all* factors necessary to produce maximum *effective operation.*

This combination entails three prime requisites:—(1) sound, advanced engineering design, (2) top quality materials and (3) adequate plant facilities coupled with skilled craftsmanship. *Pennsylvania* has "all three."

Power Transformers are built to rigid specifications. *Pennsylvania's* ability to fulfill the most exacting requirements has been demonstrated by the successful manufacture of transformers as large as 30,000 KVA and 165,000 V; the largest air cooled Welding Transformers ever made; some of the largest Furnace Transformers in existence; and the development of transformers with underload tap changers.

Pick Pennsylvanias for performance.

* **PERFORMANCE**—the execution of the functions required; effective operation. —Webster

Pennsylvania Transformer Company

808 RIDGE AVENUE N. S. PITTSBURGH 12, PA.

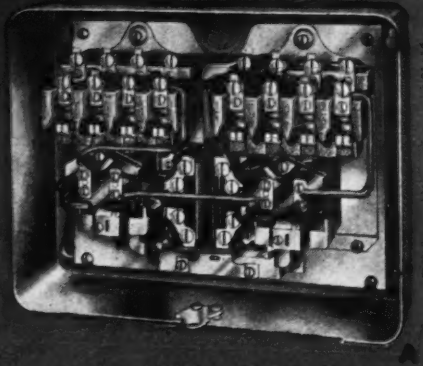
Pennsylvania TRANSFORMERS

Federal

INDUSTRIAL CONTROLS

engineered to outlast the equipment they control

Don't be surprised if the Federal controls you buy for one machine *outlasts* two, three or even four others. For—Federal builds 'em for long life. Designs them to withstand the rigors of hard usage. To take in stride shocks . . . vibrations — or what have you. Expect to find, too, ample wiring space . . . easily removable contacts . . . efficient operation . . . ease and economy in maintenance. For safe and dependable control of motor-driven machinery depend on Federal.



A

B

A. Reversing magnetic starter Type "A" sheet steel cabinet

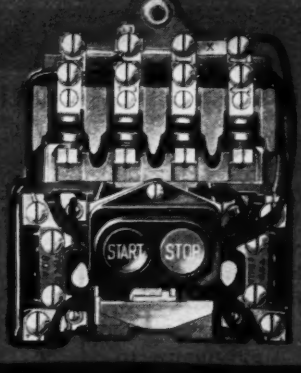
B. Combination motor starter Type "B" weatherproof cabinet

C. Manual Motor starter Type "A" sheet steel cabinet

D. Magnetic Motor starter Type "U"—inside only

E. Push button station

C



D

E

FEDERAL ELECTRIC PRODUCTS COMPANY

Plants at: 1429 Park Street, Hartford, Connecticut and 80 Paris Street, Newark, New Jersey

ANOTHER SYLVANIA

THE FIRST AND ONLY PLANNED FLUORESCENT MAINTENANCE SERVICE

A Brand-New Business-Building Plan for Electrical Contractors, Utilities, Jobbers!

Here's how this new and exclusive Sylvania Service Plan works.

Electrical contractors (selected and qualified) in every territory—backed by Sylvania's technical assistance and business helps—will furnish stores, offices, and other commercial establishments with a *complete* fluorescent maintenance service—offered *on a contract basis* at a low monthly rate.

The service will include everything needed to keep the customer's lighting system at peak efficiency . . . periodic cleaning of reflectors and lamps, replacement of lamps and other parts, and necessary repairs.

It's a service that stores and offices have long wanted. That's *proved* by the way firms already offering the service are cashing in on their maintenance contracts. Leading utilities have given the plan their enthusiastic approval . . . jobbers see prospects for increased sales.

Read below just what this plan means to *you* . . . then write to Sylvania for full details.

WHAT THE NEW SYLVANIA FLUORESCENT MAINTENANCE SERVICE MEANS TO YOU!

CONTRACTORS

1. Direct profits from a whole new field of activity made *easy* to enter with Sylvania's help.
2. Favorable contacts with fluorescent *users*—opening the door to sales of larger installations.
3. An outstanding opportunity to build up prospect lists for the sale of other services or merchandise.
4. A powerful sales aid in approaching *new* prospects for fluorescent lighting installations.

UTILITIES

1. Maintained lighting load—through elimination of lamp outages.
2. Relief from nuisance service calls from commercial customers wanting additional fixture repairs.
3. More favorable user-reaction to high-intensity fluorescent—paving the way for additional installations and more power sales.
4. The assurance that firms offering the service are backed by Sylvania's technical assistance.

JOBBERS

1. An immediate increase in lamp replacement sales for you and your electrical contractors.
2. A new sales feature for you and your electrical contractors to use in promoting fluorescent lighting among commercial prospects.
3. A powerful selling aid in the enthusiastic reaction of public utility lighting experts.
4. Opportunities for increased sales of allied equipment to concerns being serviced by this plan.
5. Opportunity to be of added service to your contractors.

FIRST!

CONTRACTORS OFFERING THIS NEW SERVICE WILL DISPLAY THIS EMBLEM

SYLVANIA FLUORESCENT LIGHTING MAINTENANCE SPECIALISTS

STEP RIGHT INTO THIS WIDE-OPEN MARKET WITH THIS 5-POINT SYLVANIA PROGRAM

TECHNICAL ADVISORY SERVICE

Sylvania offers to contractors technical information and guidance . . . training assistance for electricians and mechanics.

OPERATIONS SYSTEM

Supplies of contract and maintenance record forms . . . assistance in analyzing installations, figuring costs and rates.

SALES INSTRUCTION

Details of a field-tested sales program . . . local sales and engineering help on your larger prospects.

PROMOTION MATERIAL

Insignia for your store front and trucks . . . suggestions for your letters . . . cuts for letterheads and newspapers.

TESTED AND PROVED DIRECT MAIL

Letters with return feature and reply cards . . . self-mailers and folders with *your* signature . . . at minimum cost to you.

SYLVANIA ELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC., SALEM, MASSACHUSETTS

MAKERS OF FLUORESCENT LAMPS, FIXTURES, ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

31 After thorough pre-drying and glazing the insulators are loaded on cars equipped with Pinco designed kiln "furniture". These racks are designed to insure even distribution of heat to every insulator on the car. They are then started on their way through the firing tunnel, moved slowly and smoothly by the hydraulic ram.

PINCO INSULATORS

Firing is one of the final operations performed upon the porcelain in the making of an insulator. Here, all the care and precise workmanship that have gone into the making, finishing and glazing of the porcelain are given permanence by blazing heat to become an integral characteristic of an insulator that will be "*Right* on the job."

Write for your copy of the Pinco Catalog showing Pinco Standard Insulators and Hardware.

Pinco Standard Insulators are catalogued in the Electrical Buyers Reference.

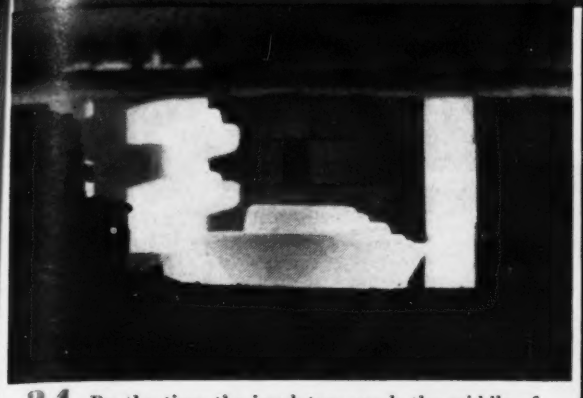
32 The Pinco continuous tunnel kiln is heated to a precise temperature by a battery of huge oil burners with automatic pyrometer controls. The burners are so spaced and controlled that as the cars progress through the kiln they pass through gradually increasing temperature to the center of the kiln, then through the lower cooling temperatures.

This is the sixth in a series of advertisements showing how Pinco Insulators are made by the wet plastic process in which all forming operations are performed with the clay in plastic form.

33 Blowers provide a continuous circulation of heat through the kiln insuring even distribution of heat to every unit on every car.

Suspension Insulators . . . . Switch & Bus Insulators . . . . Distribution Pin Types and Guy Strains . . . . One Piece & Multi-part High Voltage Pin Types . . . . Suspension & Strain Clamps . . . .

What's Behind "RIGHT on the Job" Service?



34 By the time the insulators reach the middle of the kiln they are heated to incandescence. Slow heating and cooling insure thorough vitrification without strains and stresses.

35 Kiln heat is accurately measured and recorded for each section by this Dial Pyrometer enabling the master kiln fireman to maintain accurate control of kiln temperature.

36 A recording potentiometer, with automatic pyrometer control, governs the burner operation at peak temperatures and traces on the firing chart a permanent record of the firing cycle.

37 The Porosity Test, shown here, forms a check on kiln firing. Pieces broken from the heaviest sections of the test insulators are placed in a dye solution (one gram basic fuchsine to 1 liter 50 per cent alcohol) under 5,000 p.s.i. for a minimum of 12 hours. Removed from the pressure chamber, dried and broken, the specimens must show no penetration.

Pyrometric cones, such as those to the left of the insulator in the above photo, show the peak temperature reached on the kiln car section where the insulator was fired.

Pinco No. 735

The Porcelain Insulator Corporation

657 Main Street, Lima, New York

SALES AGENTS—JOSLYN MFG. & SUPPLY CO., Chicago 6, Ill.; Kansas City 16, Mo.; Monticello 2, Ind.; Omaha 4, Neb.; Springfield, Ill.; The Joslyn Company, New York 5, N. Y.; Baltimore 25, Md.; Philadelphia 2, Pa.; Richmond 21, Va.; Rochester 10, N. Y.; Washington 8, D. C.; South East Joslyn Co., Cincinnati 7, Ohio; Atlanta 3, Ga.; Cleveland 13, Ohio; Jacksonville, Fla.; Lexington, Ky; Jobbers Supply Company, St. Paul 4, Minn., Portland 9, Ore.; Seattle 4, Wash.; Southern Joslyn Co., New Orleans 19, La.; Joslyn Southwest Co., Dallas 1, Tex.; Houston 4, Tex.; Joslyn Co. of California, Los Angeles 11, Calif.; San Francisco 3, Calif.; H. E. Burns, Pittsburg, Pa.; Paul A. Douden Co., Denver 2, Colo.; Paul Carson, Amarillo, Tex.; J. J. Costello, Boston 16, Mass.

Distribution Clamps . . . . Transmission Line Fittings . . . . Transformer & Circuit Breaker Bushings . . . . Indoor Bus Support Porcelain . . . . Tree Insulators . . . . Lightning Arrester Porcelain

STOP "Leap-Frog" Corrosion

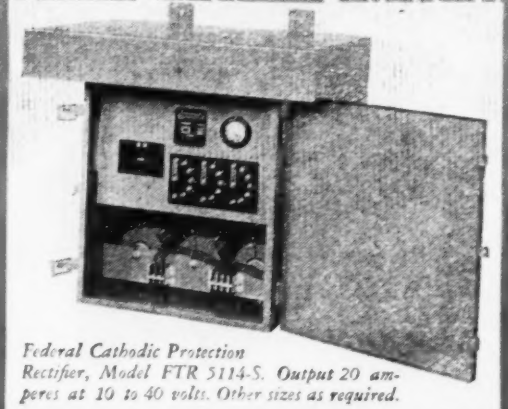
"Leap-Frog" Corrosion damages underground pipes and cables.

Pipes or other metal structures are in places electro-positive in relation to the soil and due to natural galvanic action corrosion results. Metal is taken away from one section of pipe and deposited somewhere else along the exposed pipe.

By using Federal Cathodic Protection Rectifiers, "Leap-Frog" corrosion is foiled. On constant guard is a direct current charge which cancels the harmful electrolytic corrosive action on oil, gas and water pipelines and underground cables.

These Federal units have no moving parts, so they last indefinitely — with the absolute minimum of attention. In desert heat or torrid dampness they keep on the job day and night.

Proper engineering for the corrosion problem at hand calls for the specialized consulting engineering service which is yours — when you look to Federal. Write today for full details.



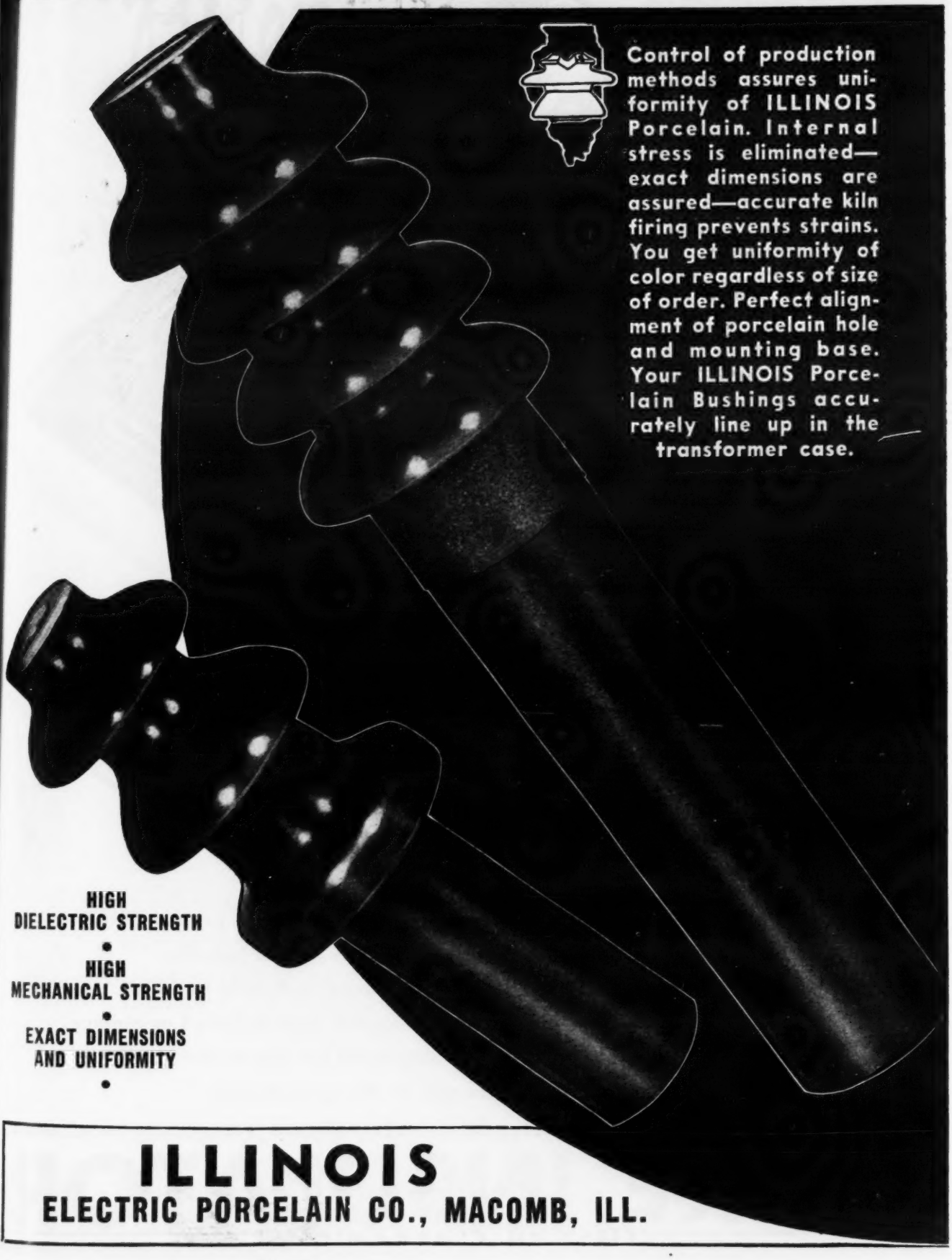
Federal Cathodic Protection Rectifier, Model FTR 5114-S. Output 20 amperes at 10 to 40 volts. Other sizes as required.

Federal Telephone and Radio Corporation

Newark 1, N. J.

An IT&T Associate

You Get Uniformity In
ILLINOIS PORCELAIN BUSHINGS



Control of production methods assures uniformity of ILLINOIS Porcelain. Internal stress is eliminated—exact dimensions are assured—accurate kiln firing prevents strains. You get uniformity of color regardless of size of order. Perfect alignment of porcelain hole and mounting base. Your ILLINOIS Porcelain Bushings accurately line up in the transformer case.

HIGH DIELECTRIC STRENGTH

•

HIGH MECHANICAL STRENGTH

•

EXACT DIMENSIONS AND UNIFORMITY

•

ILLINOIS
ELECTRIC PORCELAIN CO., MACOMB, ILL.

designed
NOTE: All surfaces to be Compression Glazed
NOTE: All Cement Grips to be Compression Sand!
from the ENGINEERING DEPT. LOCKE INSULATOR CORP.

Locke Clamp-types

1. Eliminate radio interference permanently.
2. Protect conductors against burning.
3. Have no loose parts to handle in the air.
4. Require no special tools to install or replace.
5. Greatly simplified hot line maintenance.

Only Locke Clamp Types give you all these advantages.

ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

FIRST IN CLAYRAMICS

TO REDUCE YOUR CONSTRUCTION AND MAINTENANCE COSTS ON MEDIUM VOLTAGE LINES . . . .

IN DESIGNING LOCKE CLAMP TYPE INSULATORS, OUR ENGINEERS INSISTED THAT THEY MUST BE EASY TO INSTALL OR REPLACE.

COMPARED WITH ORDINARY PIN TYPE INSULATORS, CONSTRUCTION TIME CAN OFTEN BE REDUCED BY AS MUCH AS 50%.

THERE ARE FOUR SIMPLE STEPS TO COMPLETE THE INSTALLATION.

1. Install the insulators minus the clamp just as you would install any other pin type insulator.
2. Before raising the conductor, put the clamp on in its approximate position just tight enough to hold.
3. Haul up the conductor and drop the clamp into place on the insulator and drive the cotter key home.
4. As the line is sagged, tighten the clamp bolts.

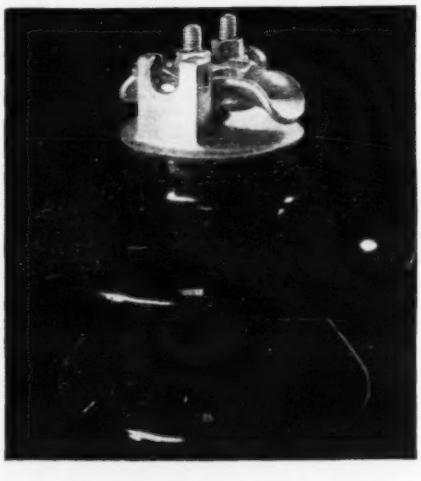
And if it is ever necessary to replace an insulator, you have only to withdraw the single cotter key, lift the clamp and conductor, install the new unit and drop the clamp back into place. Resagging is completely eliminated.

★

★

This is only one of the many exclusive features of these better pin type insulators.

Before you decide on the insulators for your next construction job, be sure to get all the details on Locke Clamp Types.



FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

LOCKE INSULATOR CORPORATION BALTIMORE MARYLAND

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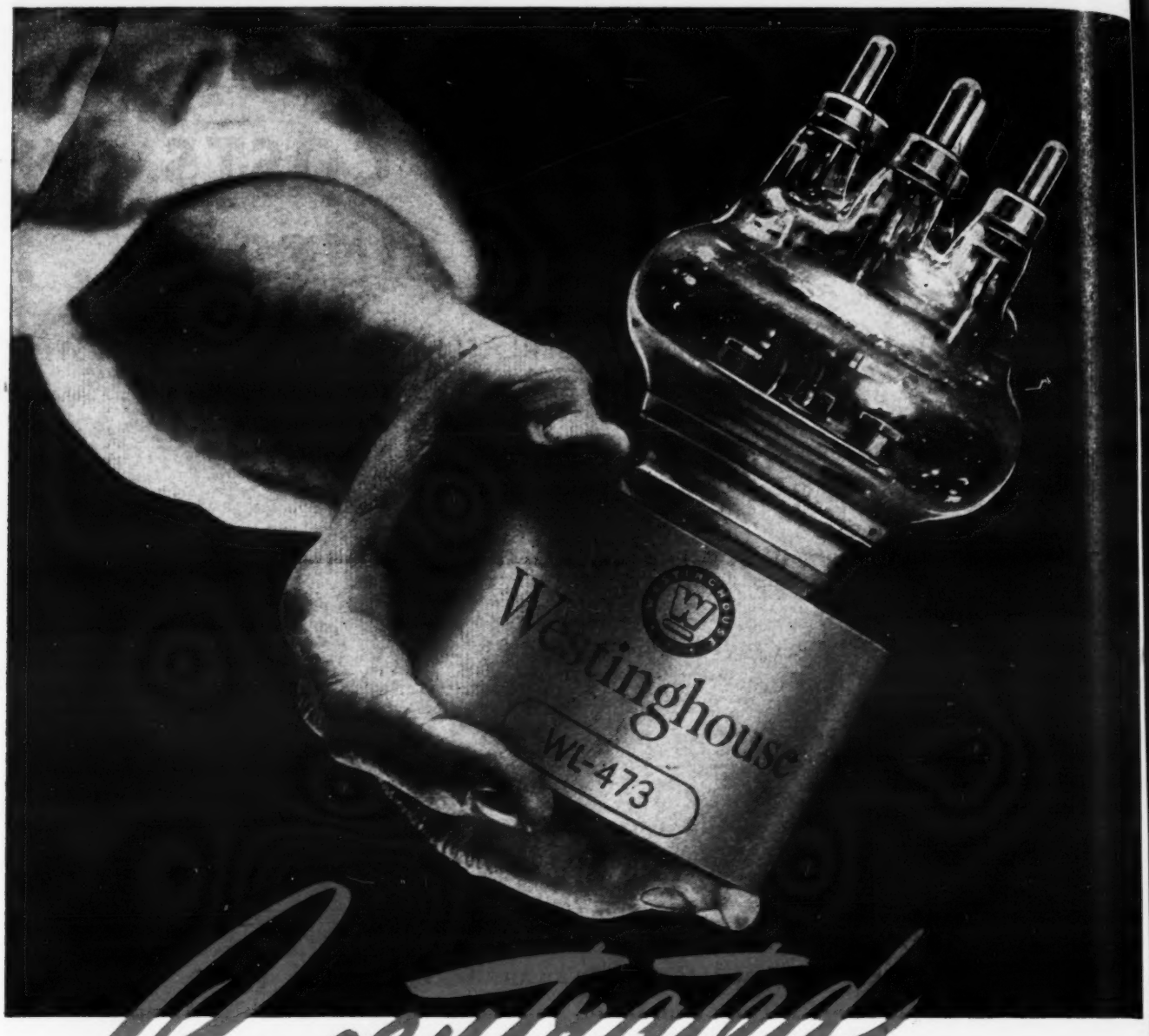


Concentrated POWER

●●● Westinghouse announces the production of a new electronic tube—a Pliotron no larger than a man's hand but delivers two and one-half kilowatts of plate power. It is low in cost but high in quality, and is designed for applications in dielectric and induction heating, and in AM and FM radio transmission.

It is small and compact even though air cooled, and designed to deliver full plate output at frequencies up to and including the present FM band.

Designers of electronic devices will find in the small size and large output of this tube the answers to many of their problems. In addition, it has the same rugged dependability that characterizes all Westinghouse Electronic Tubes.

The outstanding features of the WL-473—which are exclusively Westinghouse—will appeal to you. Ask your nearest Westinghouse Electronic Tube Distributor or write to the Westinghouse Electric and Manufacturing Co., Lamp Division, Bloomfield, N. J., for complete information.

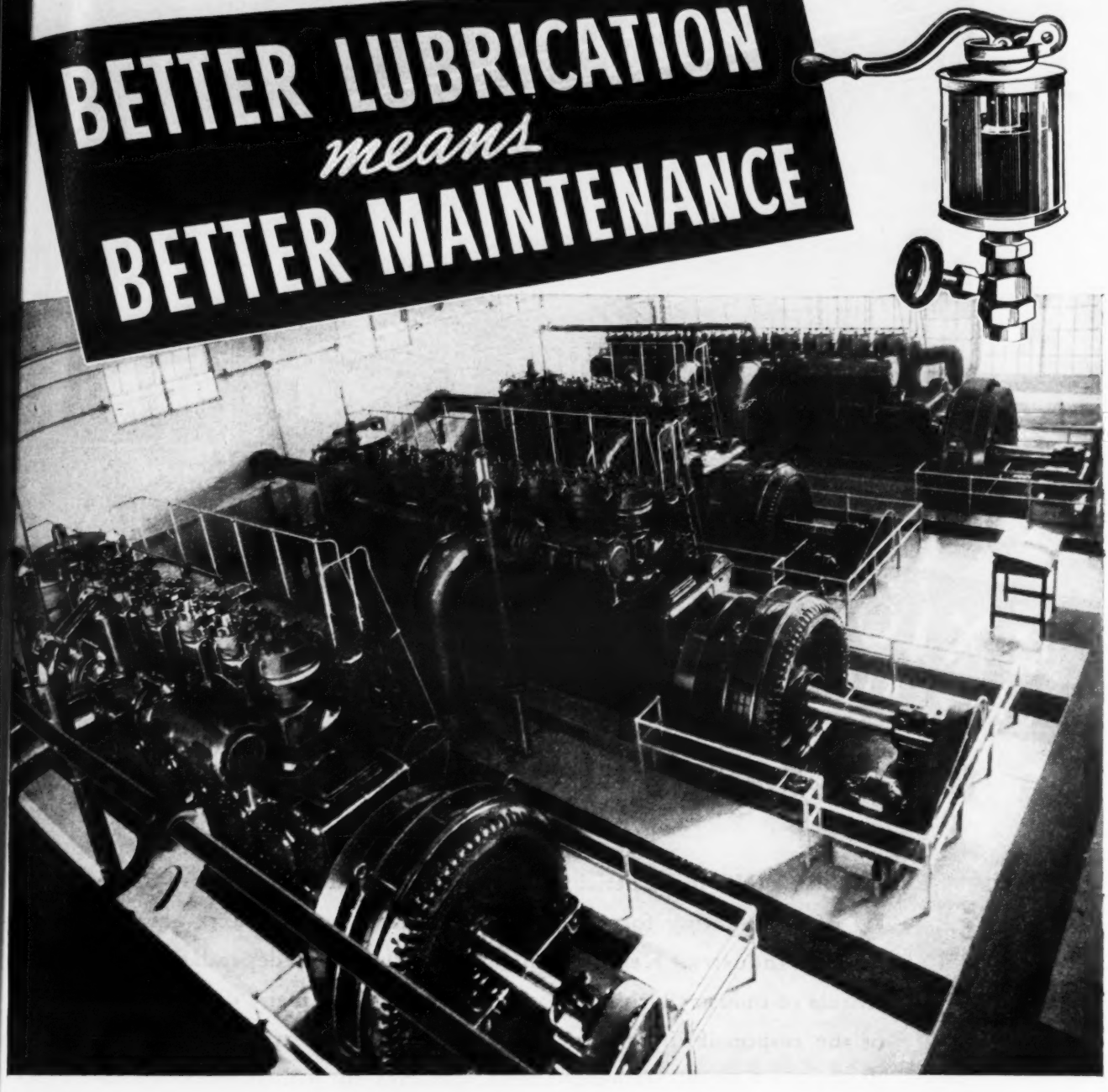
Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Quality Controlled Electronic Tubes

WESTINGHOUSE PRESENTS John Charles Thomas • Sunday 2:30 EWT, N.B.C. ★ Ted Malone • Monday, Wednesday, Friday—10:15 EWT—Blue Network

BETTER LUBRICATION *means* BETTER MAINTENANCE



IF you are experiencing difficult maintenance, better check lubrication. It may be inadequate with resultant excessive wear.

Sinclair offers better lubrication for better maintenance of DIESEL equipment. Sinclair RUBILENE and GASCON OILS have high oiliness and non-oxidizing, non-sludging qualities. They reduce ring and liner wear... prevent scoring and ring-sticking.

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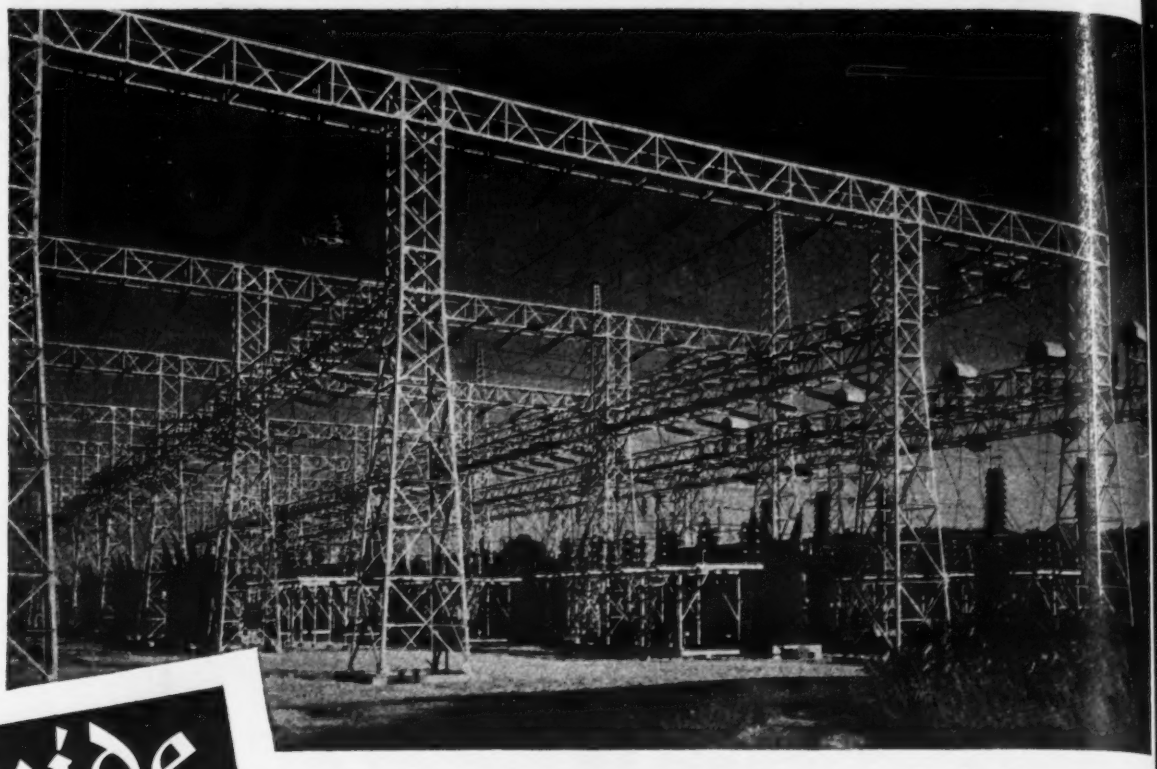
(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.



Exide BATTERIES

...as dependable as the great Central Stations they serve

SUPPLYING the material needs of our fighting forces is the job of industry. Keeping the wheels of industry turning is part of the responsibility assigned to America's Central Stations. That they have been able to meet industry's greatly increased power requirements is a noteworthy achievement. Efficient management, aided by capable workers, has made this possible. Fine, modern equipment, also, has been a contributing factor.

Among this fine, modern equipment are thousands of Exide Batteries, which are quietly, powerfully and dependably performing their many duties. Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life and ease of maintenance. When you buy an Exide, you *Buy to Last.*

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

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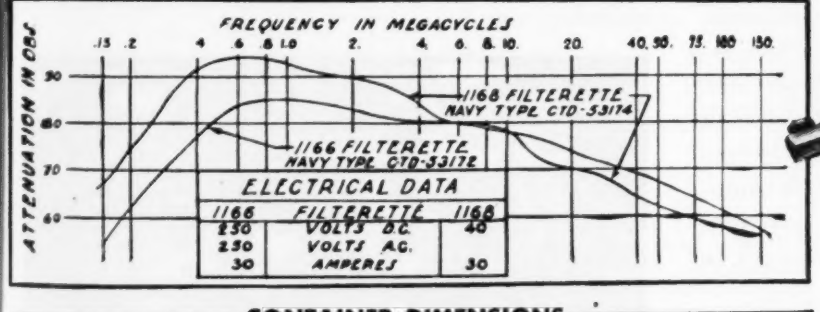
IN THE FIELD OF RADIO NOISE ELIMINATION TOBE IS THE ACKNOWLEDGED LEADER

ONE engineering result of the war is increased knowledge of radio interference problems. It will never be lightly treated again. No engineer can tackle the development of an electrical design without giving due consideration to minimizing the radio interference it creates in operation. Specially designed filters, to be built into electrical circuits, can usually solve the problem of radio interference.

Here at Tobe is a great storehouse of knowledge in this subject. It is *sound* knowledge, gained by the most intense interest and experience of any company in the field.

Tobe Filterizing is a copyright term. It means that Tobe knows how to "filterize" man-made radio noise. Why not make use of this valuable 16 years' of experience in your own engineering? Place your reliance on Tobe and the famous Tobe Filterettes. Send us your problems now.

LONG LIFE ASSURED!



CONTAINER DIMENSIONS

Length . . 4 7/16" Width . . 2 1/8" Height . . 2 7/8" Overall length 6 1/4"

SUPPRESS MAN-MADE RADIO STATIC

TOBE FILTERIZED

Tobe Deutschmann Corporation

CANTON, MASSACHUSETTS

A small part in Victory Today — **A BIG PART IN INDUSTRY TOMORROW**

Great Events in the History of...

COMMUNICATIONS!

The Telephone Talks! "Mr. Watson, come here, I want you!" This sentence, spoken by Alexander Graham Bell in his Boston workshop on March 10, 1876, to summon his assistant, was the first ever transmitted by telephone. This great event led to the founding of the Bell Telephone System—for which Western Electric has been the manufacturer since 1882.

EVEN BEFORE the first of these historic events, Western Electric—founded in 1869—was making electrical communications equipment.

The Company's work as maker of Bell Telephone apparatus since 1882 has led to many other sound-transmission products which enrich your life. Radio in all its forms—talking picture equipment—train dispatching equipment—public address systems—hearing aids—all owe much to the pioneering work of Western Electric.

This year—as the Company marks its 75th Anniversary—Western Electric is the nation's largest producer of electronic and communications equipment to speed victory.

Buy all the War Bonds you can—and keep all you buy!

The Telephone Spans the Continent! On January 25, 1915, Mr. Bell in New York, once more talked to Mr. Watson, this time in San Francisco, on a momentous occasion—the opening of telephone service across America. This was made possible by Western Electric vacuum tube repeaters—first of many millions made for the Bell System.

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75TH ANNIVERSARY

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT

Charter Oak, Conn. *Etching by Edward C. Smith*

...How Necessary is Tree Trimming to Utility Companies?

The vast network of overhead power lines presents many problems to utilities — foremost being the *correct* trimming of tree branches around the wires to insure uninterrupted service — and at the same time preserve the trees!

Here's what utilities gain by trimming trees around the lines correctly.

Trees are important to home owners for their beauty, sentiment and aesthetic values — and must be kept so!

The satisfaction or disapproval of an entire community is directly affected by the policy of the company's tree policy.

Public relations are injured by serious interruptions — a single limb can interrupt service in several towns.

All reasons for using Asplundh Tree Expert Company's tree trimming service!

Today, many utility companies are using the Asplundh Tree Expert Company's services. With post-war expansion, we will be in a position to take care of additional needs.

The 675 Asplundh Tree Expert Company's men, returning from the armed forces, will enable our company to add to its present large organization to meet your growing needs for correctly trimmed trees.

Economical Line Clearing

ASPLUNDH TREE EXPERT COMPANY
JENKINTOWN • PENNSYLVANIA

BRANCH OFFICES: Chicago, Ill.; Binghamton, N. Y.; Columbus, Ohio; Tulsa, Oklahoma; Alexandria, Va.; Washington, D. C.; Baltimore, Md.; Charlotte, N. C.; River Edge, N. J.; New Castle, Pa.; Pittsburgh, Pa.; Omaha, Nebr.

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Spring *Summer* *Autumn* *Winter*

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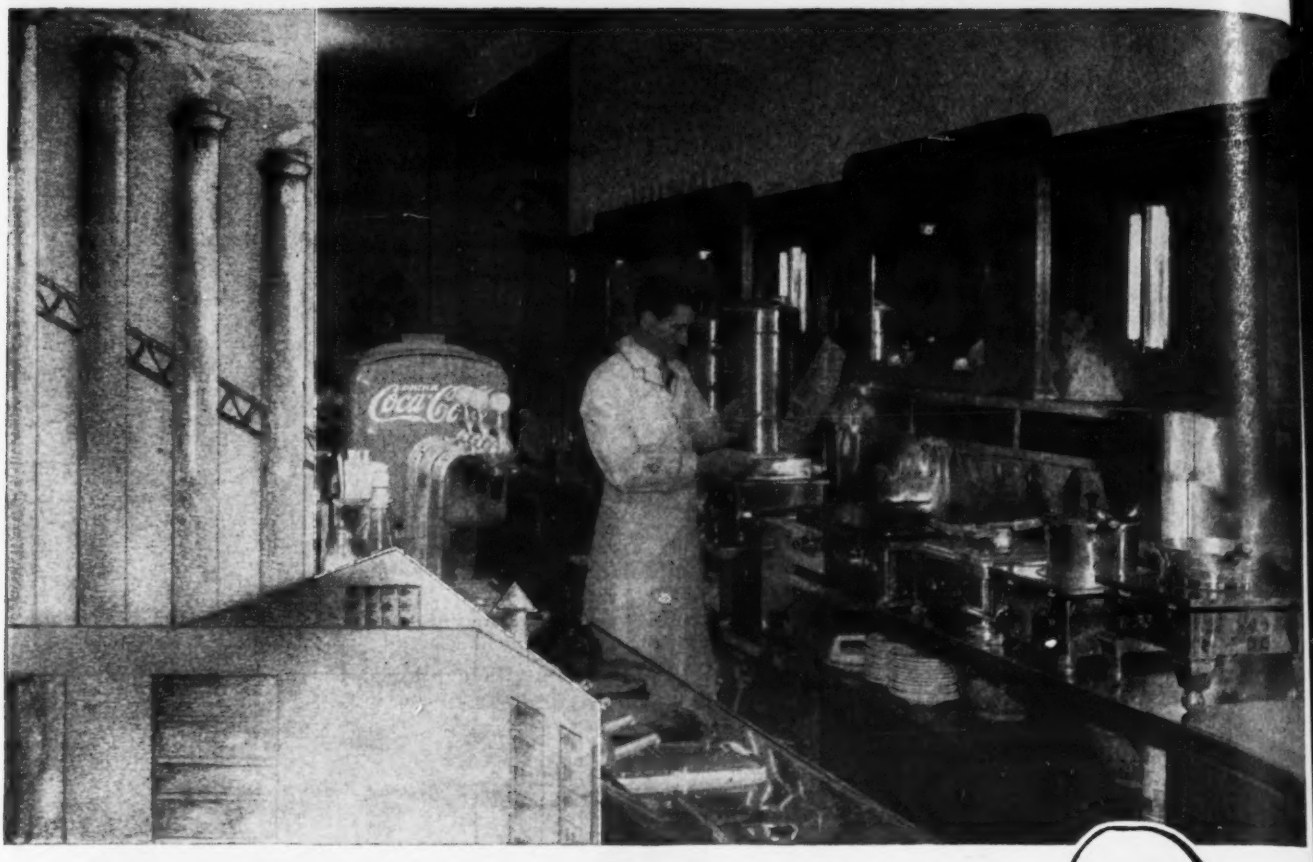


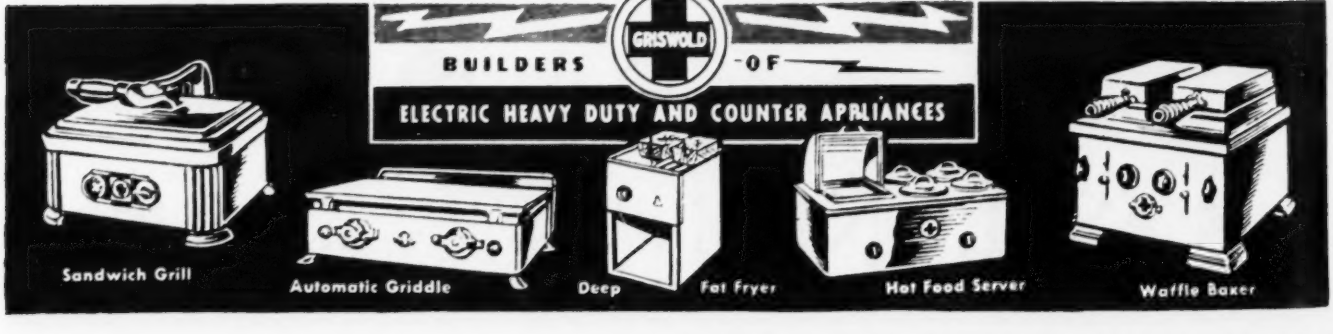
GRISWOLD

ELECTRICAL COOKING EQUIPMENT *Will Help* MAINTAIN LOAD...

THE wide use of Griswold Counter Appliances for backbar and window display cooking in every spot where the public is in the habit of stopping for a full meal or just a snack, will do much to keep a new high average load when America returns to the pursuits of peace. . . The tremendous load requirement now being met by the utilities so efficiently during this wartime emergency, clearly indicates that a multiplicity of small electric units in general business and industry will be needed. . . There is no better field from which to gain additional load than the food service field. . . And the Griswold line of counter, window display and backbar appliances, plus heavy duty equipment for the kitchen is complete. . . Your Griswold man will help map out your plans for cultivating this market.

If your present equipment is inadequate or beyond repair, the government permits the manufacture of a limited quantity of Griswold equipment. You may be able to purchase what you need. Your Griswold man can help you determine your eligibility.

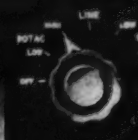
THE GRISWOLD MFG. COMPANY • ERIE, PA.



IT'S SIMPLE AS

Photo Courtesy Boston Gear Works

A



Turn this knob to "LOW" or "HIGH," wait a few seconds

B

Slowly rotate this knob until the machine or moving part appears to be stationary

C

Read the speed here from 600 to 14,400 rpm, or by simple conversion read rpm up to as high as 100,000

To *MEASURE SPEED* and *STUDY MOTION*

• WITH THE STROBOTAC you can see any part of a machine in s-l-o-w motion . . . as slow as a fraction of an rpm if desired . . . while the machine is running at its normal speed! No mechanical connection between the equipment under observation and the STROBOTAC is required.

You can 'stop' motion in machinery and measure its exact speed to an accuracy of one per cent; then you can make it go through its paces running either forward or backward so that you can see any misadjustments, worn parts, slippage or other mechanical troubles.

The STROBOTAC has proven invaluable to thousands of designers, research engineers, maintenance men and salesmen . . . it can help YOU in designing equipment and in keeping it running. The price? Only $95.00, complete and ready to use.

STROBOTACS are being manufactured only for the war effort at present. If yours is an urgent war need, you can obtain the necessary allocation from the W.P.B. After the war, STROBOTACS and other G-R stroboscopic equipment will again be available generally to help keep the wheels of Industry turning.

For Complete Information WRITE FOR BULLETIN 906

GENERAL RADIO COMPANY

Cambridge 39, Massachusetts
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SAFELY MAINTAIN INSULATING OIL

this SIMPLE, FOOLPROOF WAY

THE De Laval Oil Purifier continuously purifies and dehydrates transformer and circuit breaker oil, making it possible to maintain the oil at high dielectric strength at a single pass and, hence, at materially reduced operating cost. Less time is required to service individual pieces of apparatus. Thus, if it is desired, oil may be dehydrated more frequently so as to constantly maintain it at higher dielectric value at no additional cost.

De Laval Oil Purifiers dehydrate oil at relatively low temperature and at constant maximum efficiency. They require a minimum of attendance, since practically automatic operation is made possible by automatic oil flow control and thermostatic heat regulation. Moreover, the De Laval Oil Purifier does not require the aid of a blotter press except to remove colloidal carbon from circuit breaker oil.

All of these factors contribute to dependable, less costly substation performance. Additional details will gladly be sent.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago
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THE DE LAVAL COMPANY, Limited
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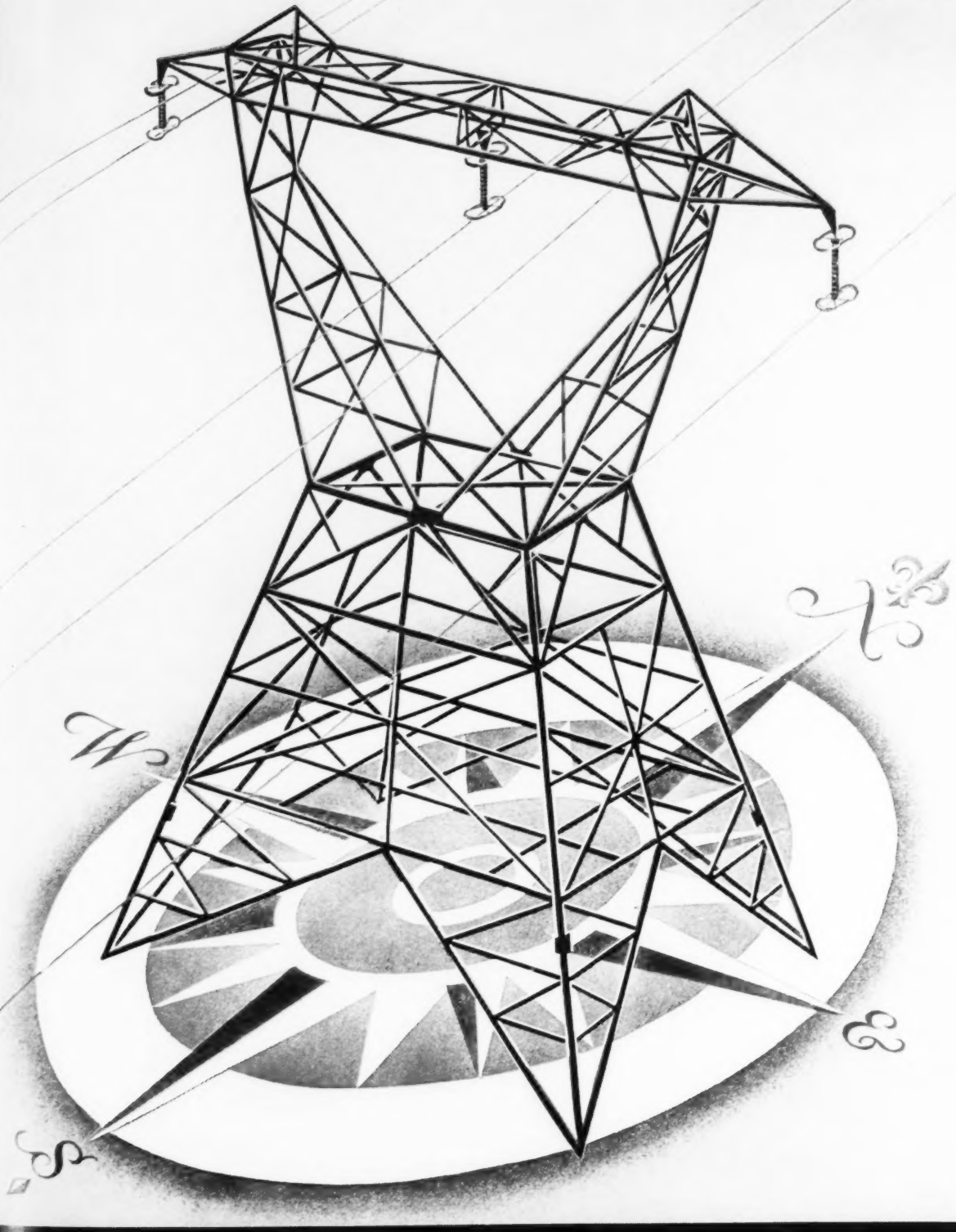
INSULATING OIL PURIFIERS

ORTH, SOUTH, EAST AND WEST

Keeping the power-lanes open has been the utility engineers' invaluable contribution to America's vast military program. Their success is attested by the fact that power failures are now so rare that industry has ceased to anticipate their possibility! North, South, East and West, utility engineers continue to favor Blaw-Knox transmission towers for their advanced design and dependable performance.

BLAW-KNOX DIVISION of Blaw-Knox Company • 2013 Farmers Bank Bldg., Pittsburgh, Pa.



BLAW-KNOX TRANSMISSION TOWERS

SHERARDUCT
ECONOMY
XDUCT JR.
111 XTENSIONDUCT—2 wires
333 METAL MOLDING—4 wires
888 METAL MOLDING—10 wires
As the shadows of War fade, Civilian requirements are quickly met by engineering years of experience safeguarded by standards of quality long proven.
CONDUITS—RACEWAYS
Underwriters Laboratories Inc. TESTED
NATIONAL
ELECTRIC PRODUCTS
NE
WIRING 6 SYSTEMS
WIRES AND CABLES
WIRES AND CABLES
Navy Cables • Signal Wire
Industrial Cables
Public Utility Power Cable
Building Wires
National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.

Electrical World

DECEMBER 23, 1944

Intelligent Regulation

FOR YEARS the electric utilities in most states have been under the regulation of public service commissions yet large sectors of the public believe that the utilities are in a big power trust, are restrictive monopolies and are anti-social. What's wrong? Has state regulation fallen down, as some government agencies would have the public believe, or has regulation itself paid too little attention to the public understanding of its functioning—to its own public relations?

Last week at a meeting of the New York Section of the American Institute of Electrical Engineers, Commissioner Bray of New York, a former lieutenant governor of the State, said, "If intelligent regulation will tend to stop tendencies more hostile to industry than the evils which industry has feared and survived before, then this kind of regulation will prove to be the greatest friend industry ever had."

There can be no question about that if regulation can deliver. So far regulation appears to have been satisfied rather generally to do its regulating and then to let the industry shift for itself in its struggle with the "hostile" forces. Is it now willing finally to come to the assistance of the industry which is only doing what it is permitted to do by regulation?

Does regulation understand, as Mr. Bray does, that while "sound regulation will prevent the anti-social use of private property, it will also prevent the destruction or impairment of the productivity and usefulness of private property?" This isn't an idle question, for there are still commissioners who look upon the utilities under their jurisdiction as predatory animals that should be caged if not destroyed.

More recently some state bodies have been battling against certain "hostile" forces not because of the injury that might be done their charges but because of the threat to their jurisdiction. To protect one's own back yard against trespass is sound but it would be much more impressive if the protective spirit were spread to cover those who operated within that area.

Before that can be done, however, the public must first understand what regulation is, that it isn't a ratchet but works both ways.

At the same time some way must be found whereby the commissions and the utilities would cooperate to promote sound regulation. Some commissioners are still independent in their thinking but too many are apparently willing to accept the regulatory principles laid down by others without weighing the consequences. The utilities should encourage sound independent thinking, try to understand all that it means and give it a fair opportunity to work out without a lot of hold-up procrastination. The courts should be the last place to work out regulatory problems.

Intelligent regulation can be a mighty protection of private property against hostile socializing raids but the encouragement for it will come only from the willing attitude of a utility industry that will cooperate—unhesitatingly, not only to make regulation work, but to help the public to know that it is working.

Locating Trouble on 3-Phase Ungrounded Secondaries

Method of finding phase grounds without sectionalizing branches of circuits or interrupting service—Apparatus practically proofed against incorrect connections, short circuits or unsafe operation

A. B. JONES, Boston Edison Co., Boston, Mass.

ACCIDENTAL PHASE GROUNDS which appear on ungrounded 3-phase distribution secondaries should be located with the least possible inconvenience to the power customers served from these lines. The ordinary methods involving sectionalizing of circuits, and interruptions to service are not often permissible. The following tracer current method, utilizing part of the apparatus used in locating cable faults, has been successfully employed for some time on the Boston Edison system is locating accidental secondary grounds without in any way inconveniencing the customers. Some hundred or so grounds are traced yearly.

Intermittent Grounds

These often involve several customers. Occasionally grounds develop on apparatus of two customers on different phases. Because of intermittent operation of apparatus simultaneous operation of both pieces of equipment is necessary to call attention to the trouble by blowing fuses. Months may elapse before this condition is discovered. An instance is recalled where wiring of elevator motors in two apartment houses was grounded on different phases. Both janitors replaced fuses repeatedly over a period of several months before the grounds were noticed and cleared.

In another instance, wiring of a three-phase compressor motor controlled by a two-pole pressure-operated switch became grounded on one of the phases opened by the switch. At a nearby customer, a control wire to a motor for operating a car mover was grounded on the same phase. The car mover was operated infrequently but when energized made the compressor motor alive on one phase through the ground. The normal phase voltage thus applied to a single phase of the compressor motor, when apparently not in use, resulted in burning out the winding. In this instance the motor was equipped with only two fuses and the third phase was protected by a larger branch fuse. Unfortunately the grounds in this case were not located by the tracer methods described here.

Grounds of intermittent character are the most difficult to eliminate, since, first, they may exist for a long time without discovery, and second, they are seldom on when a troubleman is working, and repeated calls are necessary. Ordinarily the troubleman is unable to spend sufficient time to locate such grounds. Frequently they must be located out of working hours or on a week-end.

Reports of secondary grounds come from meter testers and installers, customers, line and cable crews.

It is suspected that there are many more grounds on three-phase services than are reported because intermittent grounds may long pass unknown.

Combination three-phase and single-phase secondaries with grounded neutrals either at mid-point of one delta phase or at mid-point of a wye are not here considered since solid-phase grounds will make themselves known by burning clear or by blowing fuses. It has been necessary

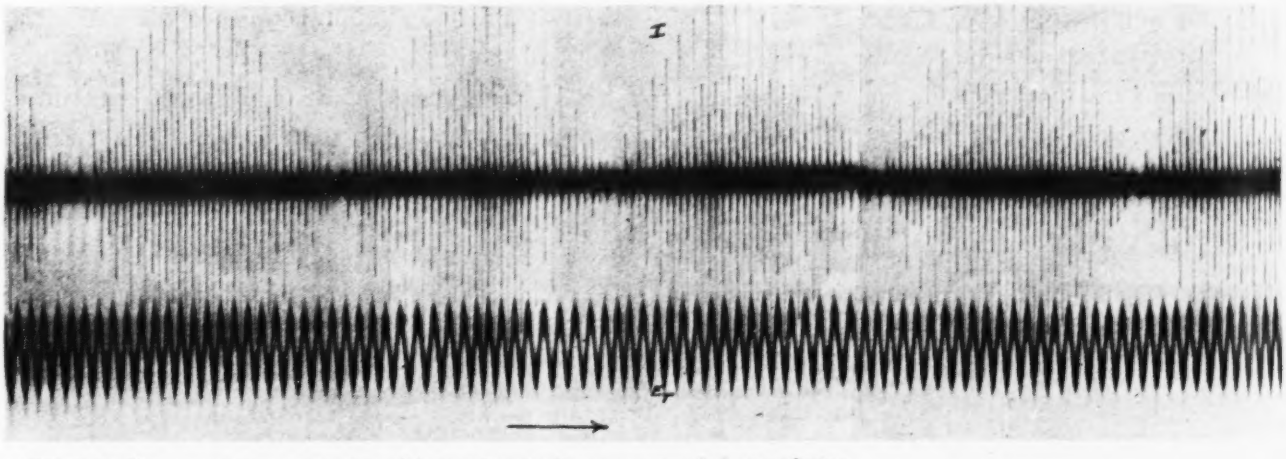


FIG. 2 Oscillogram of tracer circuit used in locating faults on ungrounded secondaries

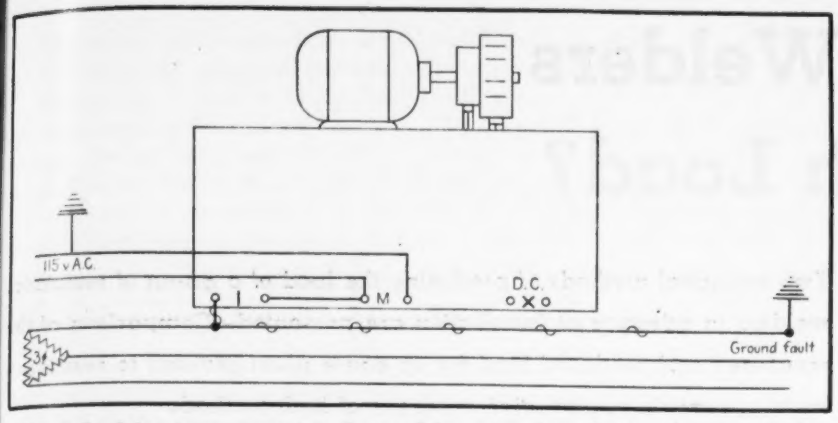


FIG. 4 Applying tracer current to the good leg away from the transformer with the ground in an intermediate position. Feed back connection

to instruct both customers and employees as to the voltage relations and the grounding of these systems.

A voltage reading between a solidly grounded phase and ground must be zero, but frequently a ground is reported in which a low phase-to-ground reading may be obtained; test lamps do not indicate, but slight shocks may be felt between apparatus and ground. Often such grounds are in customers' apparatus in units in which insulation resistance decreases with temperature. This is plainly customers' trouble. We are interested primarily in grounds solid enough to carry appreciable current.

Tracer Current Locates Grounds

In this method the location of the fault is a problem of interpreting the sounds picked up by an exploring coil and ear phone, from a tracer current superimposed on the secondary main by means of an interrupter. The sound is followed along the circuit to the blades or fuses; any place where the conductor is accessible. Following the return tracer current in conduit or metal sheaths is unsatisfactory except under certain conditions.

The interrupter consists of a motor-driven commutator suitably connected to the main through chokes and condensers (Fig. 1). An oscillogram (Fig. 2) of the wave produced shows long volume swells covering approximately 19 cycles of the 60-cycle timing wave. These swells produce the distinctive sound of the tracer current which is readily followed and easily recognized by the presence of a strong power hum. The interrupter sound may be described as a slowly repeated "WOW-wow . . . ". The swells are the result of the induction motor slip and may be altered in frequency by changing the slip. Analysis of the wave form shown indicated the presence of odd harmonics up to the 25th and higher.

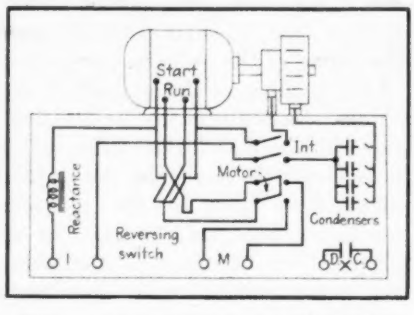


FIG. 1 Arrangement of interrupter which superimposes tracer current on circuit under test

The tracer current is applied as indicated in the diagrams. In the "Feed Out" connection (Fig. 3) sound is heard strongest in the grounded leg. By applying tracer current to a good leg away from the transformer (Fig. 4) with the fault in an intermediate position, some advantage is gained in that the signal is strongest in one wire to the branch containing the grounded leg, and is found in two legs between the grounded branch and the transformer, thus leading one more positively to the branch containing the fault. This method also permits the use of the good phase of the 3-phase circuit itself to supply power for the fault-locating apparatus.

By means of a copper bar shunt arranged to bypass the tracer current in cable sheath around the exploring coil, the experienced operator can locate a fault in a sheathed cable. The tracer current follows the conductor to the fault, passes to the sheath and divides, part going ahead to other return paths and part back over the sheath toward the interrupter. If the exploring coil is placed on the sheath and the sheath current is shunted past the exploring coil, the volume of tracer sound will diminish when the coil is ahead of the fault on the circuit from the interrupter. In this case the tracer current flows mainly in the sheath and bypassing this current reduces the signal. If the exploring coil is ahead of the fault on the cir-sheath back of the fault the volume of tracer sound will increase when the shunt is contacted. In this case the neutralizing effect of the return sheath tracer current is divided when the shunt bypasses part of the current past the exploring coil, thus increasing the signal. The operator holds the exploring coil fixed on the sheath and makes and breaks contact with the shunt, noting whether the sound increases or decreases.

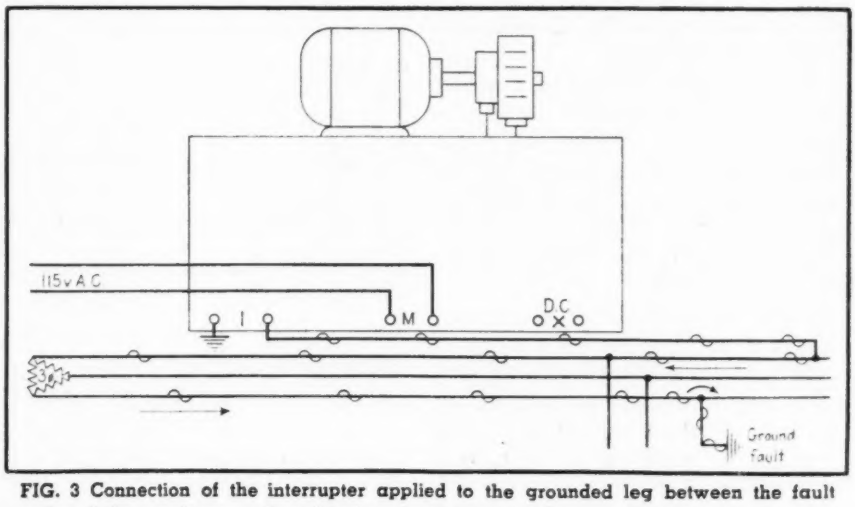


FIG. 3 Connection of the interrupter applied to the grounded leg between the fault end and the tranformer. Sound is heard strongest in the grounded leg. Tracer current travel in this, the feed out method, is as indicated

Resistance Welders —How Much Load?

Two empirical methods of predicting the load of a group of resistance welders in advance of installation are presented—Comparison of the measured and predicted load for an entire plant devoted to resistance welding reveals comparative accuracy of both methods

L. W. CLARK, Planning Engineer, The Detroit Edison Co., Detroit, Mich.

HOW MUCH LOAD will there be from a group of resistance welders? This and the question of voltage are prime considerations in providing electric service facilities for resistance welders. First of all, capacity provided must insure not only ample voltage when equipment is operating but also freedom from lamp flicker at nearby lighting installations. Once power supply facilities are found adequate from a voltage standpoint, it is necessary to make sure that the current carrying ability is adequate for the welding load.

TABLE I

Multipliers For Estimating Welder Load

Type of Welder	Multiplier
Spot, Butt, Projection, Flash, Hydromatic	0.2
Spot, Butt and Protection with Pulsation Control	0.4
Seam	0.7

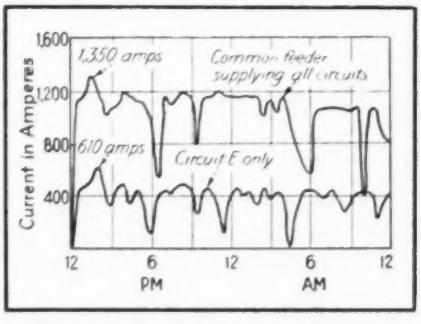
Probable Maximum Thermal Load in Kva. = "Nameplate Kva. Rating" times "Multiplier."

But to predict the load of a welder group it is desirable to know the primary current drawn by each welder, the weld time and the production rate in welds per hour. Initially, however, all that may be known is the type and nameplate ratings of the proposed machines.

Under such circumstances an approximation of the load of a group of welders can be obtained with the simple multipliers given in Table I. If, for instance, the group of welders in question is made up of spot, projection, butt, flash or hydromatic, the sum of the nameplate ratings multiplied by 0.2 will give the approximate maximum equivalent continuous thermal load in kva. This method of predicting load is based entirely upon the rating of the welders, irrespective of the loading of the individual machines. Results may not be too accurate but where no further information is immediately available, the method gives some idea of the probable maximum facilities that may be required from a thermal standpoint. Where pulsation control is applied to spot, butt, or projection welders, the multiplier becomes 0.4 and for seam welders the multiplier is 0.7, as indicated in the table.

A More Accurate Method

Where more information is available, such as the actual primary current during welding, the weld time and the number of welds per hour, it is possible to calculate the expected load with more accuracy. First with these data available, the operating duty cycle of each machine can be determined. The square root of the duty cycle multipled by the actual primary current gives the approximate equivalent continuous current for that machine.



MEASURED CURRENT in welder feeder circuits as given by thermal ammeter

TABLE III

Comparison of Measured and Predicted Loads

Circuit	Measured Load With Thermal Ammeter	Approximate Load Estimate From Nameplate Rating	Calculated Load From Maximum Load and Duty Cycle
A	305 Amp.	390 Amp.	321 Amp.
B	255 Amp.	390 Amp.	339 Amp.
C	380 Amp.	570 Amp.	704 Amp.
D	520 Amp.	560 Amp.	516 Amp.
E	610 Amp.	730 Amp.	629 Amp.
Total	1,320 Amp.	2,600 Amp.	2,170 Amp.

In the case of a group of welders, if all machines should repeatedly "hit" together, a maximum value of load would result; conversely, if there were a minimum of coincidence between machine operations, a minimum value of load would result. Obviously, the actual value will fall somewhere between these two extremes, depending upon how often and for what period of time the individual machines happen to coincide in their operations. No doubt fairly accurate calculations could be made according to the laws of probability, but any such calculations are tedious and complicated, and are not warranted in view of the uncertainties of the basic data usually available.

Several schemes for combining the values of the equivalent continuous loads of several individual welders have been proposed in order to obtain the amount of load for the entire group. Of these, one—proposed by F. E. Sanford, Cincinnati Gas & Elec-

tric Co.—which gives reasonably accurate results and which is perhaps the most simple, is that in which the equivalent continuous current of the machine having the greatest load is added to 60 percent of the sum of the equivalent continuous currents of the remaining machines of the group. It will be noted that this method of load prediction differs from the first method described, in that calculations are based upon actual loads on the individual welders rather than upon nameplate ratings.

Accuracy Checked

An opportunity for checking the accuracy of the above two methods was recently furnished by a new installation where practically the entire plant was devoted to resistance welding. The welders were arranged in five separate groups, each group being supplied by a separate circuit.

Data required for estimating loads according to the first method were read directly from the nameplates of the various machines, (See Table III).

For the second method, the primary current, weld time and production in welds per hour were measured at each machine. From these data the equivalent continuous current for each machine was calculated as previously described. Then, by taking the equivalent continuous current of that machine on each circuit having the greatest load, and adding to it 60 percent of the equivalent continuous currents of the other machines on the circuit, the predicted equivalent continuous current for the circuit was obtained. The values are given in Table II.

The actual current in each welder circuit as well as the current in the main supply to the five circuits was then measured by means of thermal-type ammeters. A 24-hr. load chart of the total welder load and of one of the five circuits is shown. Note that the value of current selected as the measured load is actually the peak value for the 24 hours with a peak duration of perhaps one or two hours. For the greater portion of the time the loads were somewhat under the peak value.

Table III which shows a comparison of the measured and predicted loads, indicates the degree of accuracy of the two methods. Neither is precise, but the degree of accuracy is thought to be in keeping with the accuracy of the fundamental data usually available. Either method will usually predict a value of load somewhat in excess of the actual load. The first method may be expected to give results well on the safe side since it is based upon the full nameplate ratings of the machines, without regard to particular machine loadings. The second method, since it is based upon actual data peculiar to a specific job set-up, may be expected to give somewhat lower values. This should be taken into account where machine schedules and production rates are subject to frequent changes.

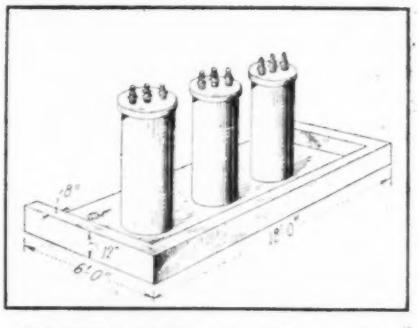
TABLE II

Welder Production and Test Data

Circuit	Type of Machine	Nameplate Rating (Kva.)	Actual Primary Current (Amp. at 480 Volts)	Welding Time (Cycles)	Production (Welds per Hour)	Duty Cycle (%)	Equivalent Continuous Current (Amp. at 480 Volts)	Largest Load And 60% of Others (Amp. at 480 Volts)
A	Flash	250	375 (Flash)	210	96	9.3	115	132
			1,150 (Upset)	8		0.4	73	
A	Flash	500	300 (Flash)	210	121	11.8	103	104
			1,100 (Upset)	8		0.4	70	
A	Flash	75	30 (Flash)	18	347	2.9	5	6
			60 (Upset)	4		0.6	5	
A	Flash	100	250 (Flash)	18	282	2.4	39	23
			0 (Upset)	0				
							Total.....	321
B	Projection	150	600	8	339	1.3	68	41
B	Projection	200	860	22	220	2.2	128	77
B	Projection	200	940	22	220	2.2	140	140
B	Projection	150	720	15	177	1.2	79	47
B	Projection	150	720	5	159	0.4	45	27
B	Spot	75	120	12	188	1.0	12	7
							Total.....	339
C	Projection	200	1,800	35	248	4.0	360	360
C	Projection	125	190	7	1,343	4.4	40	24
C	Projection	150	320	8	323	1.2	35	21
C	Projection	150	420	15	135	1.0	42	25
C	Projection	500	1,780	20	182	1.7	232	139
C	Projection	250	1,900	12	254	1.4	225	135
							Total.....	704
D	Seam	150	380	1,440	61	40.7	243	146
D	Seam	150	400	1,440	61	40.7	256	256
D	Spot	50	125	6	4,760	13.2	45	27
D	Spot	50	125	6	4,760	13.2	45	27
D	Spot	75	220	7	1,228	4.0	44	26
D	Spot	75	220	7	1,228	4.0	44	26
D	Spot	50	80	8	840	3.1	14	8
							Total.....	516
E	Spot	50	45	10	4,360	20.2	20	12
E	Spot	50	35	8	1,616	6.0	9	5
E	Spot	50	35	8	1,616	6.0	9	5
E	Seam	150	400	1,440	61	40.7	256	256
E	Seam	150	400	1,440	61	40.7	256	154
E	Spot	75	250	10	1,655	7.7	70	42
E	Spot	75	250	9	1,655	6.9	66	40
E	Spot	150	450	18	428	3.6	86	52
E	Spot	50	50	6	624	1.7	7	4
E	Spot	50	50	7	1,248	4.0	10	6
E	Spot	50	50	8	1,248	4.6	11	7
E	Spot	50	50	6	624	1.7	7	4
E	Spot	50	180	35	924	15.0	70	42
							Total.....	629
	Probable Equivalent Continuous Current For All Five Circuits.....							2,170 Amp.

Oil Floods Prevented by Low Concrete Wall

Oil floods on the floor of the transformer room in the event of tank failure are prevented by the construction of a low concrete wall around



CONCRETE WALL 12-in. high and 8-in. thick around three 1,000-kva. transformers confines any leaking oil which drains through 4-in. runoff in corner

the transformers. The cubical content of the interior is just large enough to accommodate all the oil in the three transformers. In the corner is a 4-in. drain which allows the oil to run into a sewer line outside the Queens Borough Gas & Electric Co., Far Rockaway, New York, generating station.

Pros and Cons of Fast Reclosure of Transmission

Merits and demerits compared with shielding, tube protection and ground fault neutralizer—Added cost only a percent or so for long single lines—Single-pole reclosure discussed

H. R. VAUGHAN, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.*

TRANSMISSION LINES can be made nearly fault proof by careful consideration of mechanical construction and protection against lightning flashover. Ground fault neutralizers may be used, if the system layout is suitable, to prevent most incipient flashovers from developing into line faults. Where these measures are not readily adaptable or are not considered economically feasible, fast reclosing of circuit breakers may be the best way to improve the reliability of a transmission line. Important lines, particularly those serving as a single source of power to a load or as a single interconnection between power sources, may justify fast reclosing in addition to fault preventive measures.

In applying fast reclosing, consideration should be given to the maximum permissible time between the inception of the fault and the completed reclosure that will meet the requirements of the load or the interconnection. The relaying and circuit breaker equipment must be capable of meeting these requirements. Finally, a comparison should be made between fast reclosing and other methods of increasing line reliability from the standpoint of operation and installed cost.

*Central Station Engineer

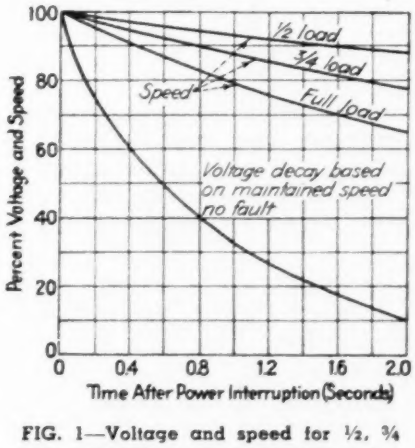


FIG. 1—Voltage and speed for ½, ¾ and full load decay of typical induction motor during power interruption. Torque varies as square of speed

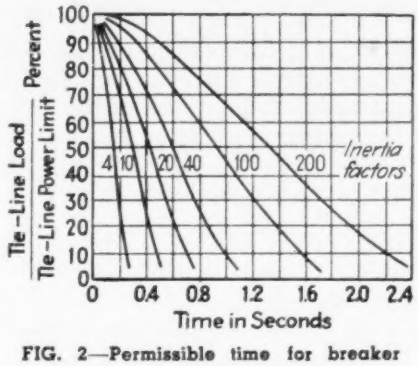


FIG. 2—Permissible time for breaker switching (three pole tripping and reclosure) without causing loss of synchronism.

$$\text{Inertia Factor} = \frac{\text{Equivalent stored energy in kva. sec.}}{\text{Tie line kw.}}$$

$$\text{Equivalent stored energy} = \frac{\text{Stored energy of sending end}}{1 + \dfrac{\text{Stored energy of sending end}}{\text{Stored energy of receiving end}}}$$

Maximum time of reclosure permitted by load or interconnection requirements will depend on whether or not a single line is involved, the type of load served or the system characteristics. If the line is supplemented by one or more parallel circuits, the speed of reclosure will usually not be important. The remaining line, or lines, will in most cases be capable of handling the load for an appreciable time without dangerously overloading equipment or resulting in dropping of load. The requirements of high speed reclosing are, therefore, in general more critical when applied to single circuit lines.

If the single circuit line serves as a radial load feeder, the required reclosure time is pretty much dependent on the type of load. A few cycles one way or the other are of little consequence to a lighting load, as there would be a noticeable flicker anyway. Induction motor loads not requiring constant and continuous speed are little affected by a few cycles interruption in power supply if they are provided with time-delay undervoltage releases to avoid having to restart the motor after reclosure.

The drop in speed of an average motor during a power interruption is shown in Fig. 1 for ½, ¾ and full load where the load torque varies as the square of the speed. Slow speed motors driving constant torque loads would decelerate faster. The residual terminal voltage would decay about as shown on the curve if the speed were maintained and applied voltage were removed without the presence of

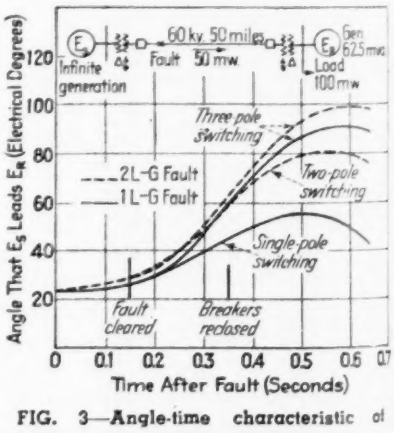


FIG. 3—Angle-time characteristic of single tie-line interconnection for three, two, and single-pole switching

a fault. The drop in speed would decrease the voltage proportionally. For example, at 0.4 second with full load on the motor the speed would be about 90 percent and the voltage about 54 percent of normal. If reclosure were made at this instant, there would be a high momentary current inrush due to the applied voltage being out of phase with the motor residual voltage. This would impose some shock to the system and might necessitate setting the pickup of any instantaneous devices higher than would normally be required by locked rotor current. However, a fault previous to breaker tripping would decay the

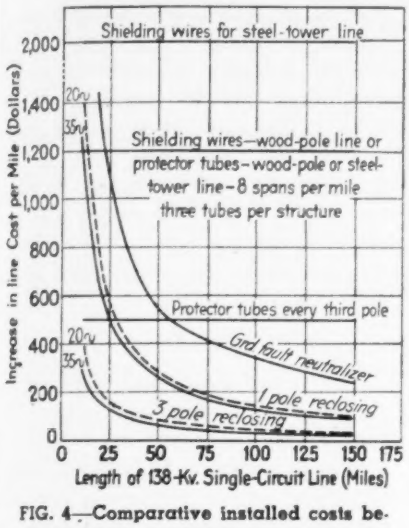

Shielding wires for steel-tower line
Shielding wires—wood-pole line or protector tubes—wood-pole or steel-tower line—8 spans per mile three tubes per structure
Protector tubes every third pole
Grd fault neutralizer
1 pole reclosing
3 pole reclosing
20~
35~
Increase in line Cost per Mile (Dollars)
Length of 138-Kv. Single-Circuit Line (Miles)

FIG. 4—Comparative installed costs between fault preventive measures and circuit breaker reclosing as a function of line length—138 kv.

motor air-gap flux rapidly so that for the majority of reclosures the motor residual voltage would be considerably lower than shown by Fig. 1.

Those motor drives that require constant speed cannot be adequately served by single circuit lines because a power interruption of even a few cycles cannot be tolerated. Such loads should be served by two or more independent lines unless the incoming power is supplemented by local generation.

Synchronous motors will in practically all cases slow down fast enough on a power interruption to fall out of step before the reclosure is completed. They may also maintain the arc for awhile after the line breaker has cleared. Therefore, it is usually necessary, or at least desirable, to open the motor starter as rapidly as possible after the fault inception and restart it automatically after the line reclosure. Relays are

Table I

Reclosing Times for Oil Circuit Breakers

600 and 1,200 Amp.—500,000 Kva. and Above

Rated Voltage of Breakers	Reclosing Time in Cycles (60 Cycle Basis)		
	Standard	High Speed	Ultra High Speed
15,000	45	30	20
23,000	45	30	20
34,500	45	30	20
46,000	45	30	20
69,000	50	30	20
115,000	60	35	20
138,000	60	35	20
161,000	60	35	20
230,000	60	35	20

available to perform this function.

If the line interconnects two systems or power sources, the maximum permissible reclosure time is fixed by the rate at which the angular positions of the two systems swing apart during the fault and the time that the line is open. If the load being interchanged just previous to the fault is small compared to the total load on each system and the rotating inertia of each system is high such as would be the case with a stand-by tie between two steam generating stations, the angular shift would be slow.

The permissible reclosure time might be a second or longer, see Fig. 2. On the other hand, a line transmitting the bulk of the power from a hydro plant to a remote system might have a maximum permissible reclosure time of 10 cycles or less and this is not practicable. A single line could, therefore, not be classed as a reliable interconnection for this type of system. The majority of applications will fall between these two extremes so that an over-all reclosure time of 20 to 30 cycles, including fault clearing time, will meet the requirements of many single circuit transmission lines that interconnect systems, each of which has an appreciable amount of generation.

Standard oil circuit breakers have a reclosing time of from 45 to 60 cycles (60-cycle basis) depending on the voltage rating. They may be provided with mechanisms to give high speed reclosing of 30 to 35 cycles or ultra high speed reclosing of 20 cycles from 15 kv. up, (Table I.)

High speed reclosing imposes extra duty on circuit breakers and will require some reduction in interrupting capacity. Table II shows the interrupting factors for new breakers for one instantaneous recloseure.

High speed reclosing, to be effective, must also include high speed fault clearing. If the line connects to a power source at each end, it is necessary to trip both line breakers

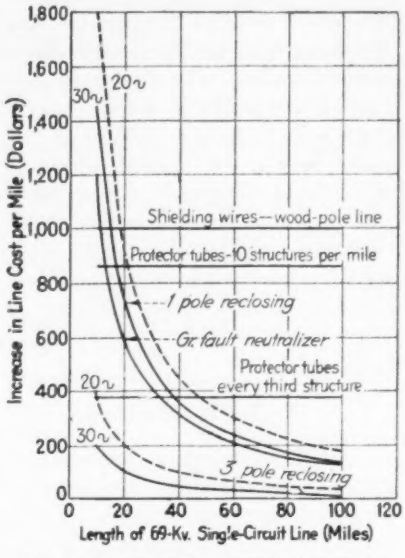


FIG. 5—Comparative installed costs between fault preventive measures and circuit breaker reclosing as a function of line length—69 kv.

simultaneously to take full advantage of available deionizing time with a minimum over-all power interruption. Either pilot wire or carrier relaying is necessary to accomplish this for faults over the entire length of the line. However, this does not necessarily involve additional relaying costs because this type of relaying is now accepted as essential to important interconnections whether reclosing breakers are used or not.

It has been conventional practice, where high speed reclosing has been applied to transmission lines, to trip and reclose all three phases regardless of the number of phases involved in a fault. However, if the system

TABLE II

Interrupting Rating Factors in Percent of Standard Interrupting Ratings One Instantaneous Reclosure

Non-Oil Tight Breaker 25,000 KVA and below	Oil Tight Breakers Above 25,000 KVA				
	0 to 5,000 amp.	5,001 to 10,000 amp.	10,001 to 20,000 amp.	20,001 to 40,000 amp.	Above 40,000 amp.
30	90	85	75	65	60

neutral at each end of the line is grounded through low impedance the reliability of single circuit transmission lines can be further increased by opening and reclosing only the faulted phase for a single line to ground fault, or the two faulted phases for a double line to ground fault. This is because a considerable amount of power can be transmitted over the sound phases during the time the faulted phase is open, thus increasing the permissible reclosing time, or, for the same reclosing time, increasing the power limit of the line for single line-to-ground or for double line-to-ground faults. The power limit for three-phase faults is the same as for three-pole reclosing because all three poles have to be opened. However, since about 85 percent of transmission line faults are single line-to-ground if cleared promptly, the overall reliability of a line can be considerably increased by single-pole reclosing over what it would be with three-pole reclosing.

Single-Pole Reclosing

Another important advantage of single-pole reclosing over three-pole reclosing is the reduction in power surges following a reclosure. Mechanical stresses on rotating equipment is thus reduced. This is apparent from Fig. 3, which shows angle-time curves of an actual system as determined by a network analyzer study. The curves show the effect of single-pole or two-pole reclosing in reducing the angular separation between systems during fault disturbances.

The cost of single-pole reclosing breakers will be greater than that of three-pole reclosing breakers, about 65 percent for 69 kv. and 20 percent for higher voltages, because each pole must be provided with an operating mechanism. The line relaying will also cost some more because the relays must be capable of selecting the phase that is faulted.

As mentioned previously, high speed reclosing may be used as either an alternative to or as a supplement to methods of reducing the number of possible faults on a transmission line. It may be of interest, therefore, to compare the two methods of improvement from the standpoint of system operation as well as cost.

Some of the operating advantages of the various schemes including line shielding, protector tubes, ground fault neutralizer, three-pole reclosing, and single-pole reclosing are summarized in Table III; disadvantages are summarized in Table IV.

The cost of providing a line with shielding wires or protector tubes is essentially proportional to the length of the line, whereas the cost of a ground fault neutralizer or fast reclosing breakers is more nearly constant, regardless of the length of the line. The curves of Fig. 4 were, therefore, drawn up to show the estimated addition in cost per mile of providing a 138-kv., single-circuit transmission line with each of the improvements considered, including installation. The curves represent what it would cost to include each of the items in a new line above the cost of a bare line. The shielding wire cost includes the additional cost of towers or poles to accommodate the shielding wires plus the wires. The ground fault neutralizer cost includes the increased cost of protective devices and transformer insulation for ungrounded neutral operation in addition to the neutralizer and its auxiliary equipment. The costs of protector tubes include an installation cost of $10 per tube, $30 per structure, in addition to the cost of the tubes. Another curve shows the cost of tubes based on three tubes per every third structure.

Cost Data

The cost of high speed reclosing includes only the increased cost of the breakers and relaying above that of standard breakers (1,500,000 kva.) and standard carrier current relaying, both of which would be essential without reclosing. The curves of Fig. 5 show similar costs for a single-circuit, 69-kv. line with 10 spans per mile and 1,000,000-kva. breakers.

High speed reclosing can be added for a very small percentage of the total line cost, less than one percent for lines of average length, and can be installed with very little difficulty. It, therefore, provides an economical and expeditious means of increasing transmission line reliability. Although it has been considered here mainly as an alternative to fault preventive methods, it can be justified as a supplement to those methods where maximum reliability is desired. Furthermore, its use is not confined to single circuit lines as it will also increase the over-all reliability of multi-circuit transmission lines.

High speed reclosing has been applied to circuit breakers up to and including 161 kv. It is estimated that 30 percent of the 115-kv. and 138-kv. circuit breakers purchased during recent years are used for reclosing service.

Table III

Single Line Operation—Operating Advantages

Effective Shielding	Protector Tubes	Ground Fault Neutralizer	Three-Pole Reclosing	Single-Pole Reclosing
Minimizes line faults. Decreases severity of surges on terminal equipment and protective devices.	Minimizes line faults. Adaptable to existing unshielded lines. Decreases severity of surges on terminal equipment and protective devices.	Clears majority of line faults (about 75%) without outage. Will transmit full power during L–G faults that are cleared.	Provides reliable source of power to most motor loads except for permanent faults. Adaptable to grounded or ungrounded neutral system.	Provides reliable source of power to most motor loads except for permanent faults. Permits considerable power interchange between systems without loss of synchronism during faults with minimum shock to system on reclosure. May not require shut down of synchronous motors during reclosure.

Table IV

Single Line Operation—Operating Disadvantages

Effective Shielding	Protector Tubes	Ground Fault Neutralizer	Three-Pole Reclosing	Single-Pole Reclosing
When flashover occurs (about 1 per year per 100 miles) outage results. Difficult to adapt to existing lines.	Outages about same as Effective Shielding. May require occasional inspection.	Requires full insulation on terminal equipment and full rated protective devices. May be affected by line switching in other parts of system. Not effective for interphase faults. May not be adaptable to existing system layout.	Requires time delay on under voltage release on induction motors. May require that synchronous motors be automatically shut down and restarted. Causes some shock to equipment on reclosure. Reduces interrupting capacity of circuit breakers.	Same as for three pole reclosing except to less extent.

Steam Plant Designed for Russia under Lend-Lease

Unusual procedures devised to correlate needs of the Russians and equipment quickly obtainable here—Pulverized lignite and waste industrial gas the fuels—Plant designed to start from cold with no outside help—Cooperation expedited early delivery

LOUIS ELLIOTT, Consulting Mechanical Engineer, Ebasco Services, Inc., New York, N. Y.

IN THE FALL of 1942 the German Army made its deepest advance into Russia, taking over many industrial areas. Restoration of production facilities in regions to the eastward became an important factor in continued resistance to the invader; that this aim was successfully accomplished is attested by subsequent history.

Under the operation of American Lend-Lease, a number of power plants were allotted to the Soviet Union, to the end of assisting our ally in maintaining necessary industrial production. Ebasco Services, Inc., of New York was engaged by United States Treasury Department, Procurement Division, to design a steam electric station for Russia, with 25,000-kw. initial capacity and laid out for 100,000-kw. ultimate.

In working out procedure for handling the job, and in obtaining basic data concerning field conditions and requirements and equipment assigned, close contact was necessary with representatives of Treasury Procurement Division of Lend-Lease organization, of Power Branch of War Production Board, and of Government Purchasing Commission of the Soviet Union in the U.S.A., as well as with manufacturers. The set-up was therefore quite complicated, but the contacts were most interesting, and a spirit of cordial cooperation prevailed. Mr. Peter L. Litvin and his associate engineers represented the Russian Purchasing Commission, and one could not but be impressed by the technical qualifications and practical competence of these Russian engineers, and their unstinted devotion to the work entrusted to them by their country.

The engineering services included preparation of specifications for sending out by Treasury Procurement, analysis of bids and advice to Treasury as to purchases, contact with manufacturers as required, and preparation of more than usually complete design drawings and bills of material. Special instructions called for a large number of copies of drawings and documents.

As the engineering company had had many years of experience in the design of foreign plants, laid out on the metric system, instructions were given that drawings and specifications for this Russian station should utilize metric measures, in order to make the designs utilizable for construction in Russia, with the maximum of conven-

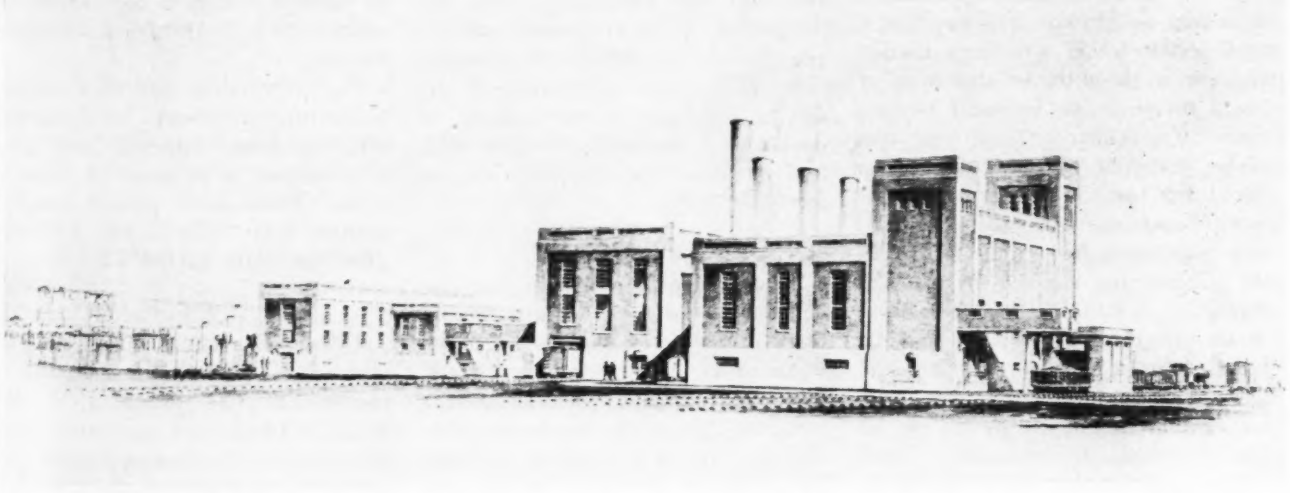


FIG. 1—**Architectural character of 100,000-kw. steam electric station (25,000-kw. initial) designed by order of U. S. Treasury Procurement Division under Lend-Lease for U.S.R.R.**

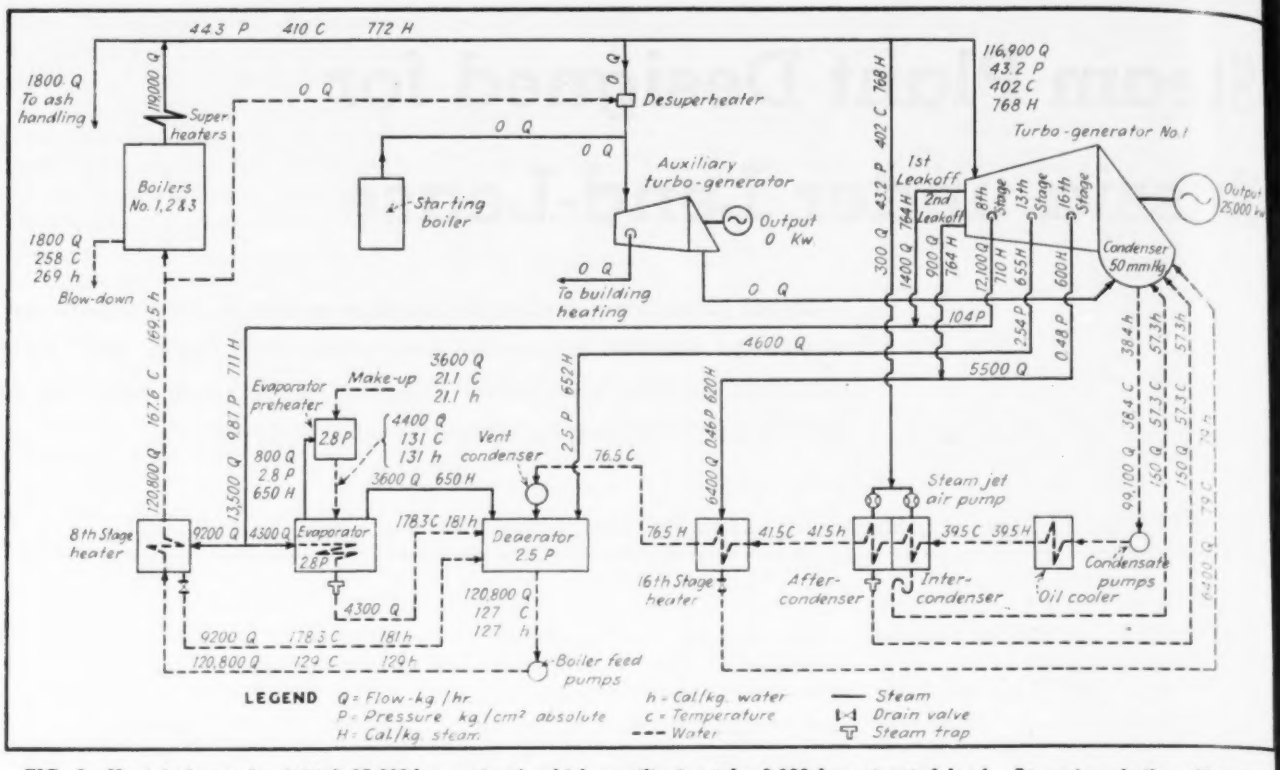


FIG. 2—Heat balance for initial 25,000-kw. unit of which auxiliaries take 2,000 kw. at rated load. At various boiler efficiencies calories per gross and net kw.-hr. are respectively as follows: 78 percent, 3,880 and 4,010; 80 percent, 3,590 and 3,910; 82 percent, 3,500 and 3,815. Steam and water flow, pressure and heat indicated

ience. (In this story, engineering quantities are given in the metric system, with English equivalents.)

To assist in the interpretation of drawings by Russian construction engineers, no abbreviations were used on drawings. Although on this job the English language was used for notes and other lettering, lettering on later drawings has been done in Russian; the tracers have had to learn to use the Russian alphabet.

Sent by Radio

The Russian Purchasing Commission sent to Moscow the key plans, and certain other drawings needed to begin work on the substructure, by radio transmission, in order to save time. For economy, these were specially prepared on small sheets, to avoid the need for transmission of large drawings in sections. All drawings were later microfilmed to the 35-mm. size, and sent by plane to Russia. Although, for microfilm, sheets up to about 50 in. can be handled in a single reduction, the amount of detail required that those larger than about 16 by 22 in. be photographed in sections. Small (letter-size) sheets were filmed in groups of four.

Most of the equipment used for the plant is of American manufacture. Major components were made available by War Production Board from projects, already begun in various parts of the United States, that were suspended as less essential to the war effort. All heavy structural material was to be obtained in Russia.

Speed in shipment of apparatus was of great importance, and since much of the mechanical and electrical equipment had already been partly or wholly manufactured, time allowed for studying the suitability of each item for the integrated plant, for adaptation when necessary, and for preparation of construction drawings, was quite short. Preliminary decisions affecting broad outlines of design were reached in October 1942, and dead-line for shipment was set for May 1943.

Factory Inspections

The engineering company was also engaged to perform certain factory inspection services, supplementing the work of U. S. Treasury inspectors. However, although the engineering company frequently supervises erection and assists in starting and testing of plants designed, in this case follow-up of equipment ceased when latter left manufacturers' shops. It was therefore necessary to adopt, under instruction from the Treasury, a complicated system of marking the shipments—so that erection engineers would know the contents of each, and would be able to determine what drawings gave details of its installation in plant. The engineers were instructed to compile complete instructions covering erection, preparation and starting of plant, accompanied by the instructions furnished by manufacturers of individual items of equipment. These manuals, of which a number of copies were furnished, each constituted a substantial volume.

No information has been received concerning movement of equipment and material shipped, and none with respect to progress of construction. These later phases comprise another story, that can be told only after the close of the war.

Conditions Set Down

Information concerning plant site, climatic conditions and operating requirements was provided by Mr. Peter L. Litvin and associates of the Government Purchasing Commission of the Soviet Union in the U.S.A.

Only general information can be given as to location of plant; it is

somewhere east of the Ural Mountains. Elevation above sea level is 250 m. (800 ft.) and climate is quite cold with lowest winter air temperature minus 40 deg. C. (minus 40 deg. F.); maximum in summer is 32 deg. C. (90 deg. F.). The short summer lasts only two or three months, but about six months of the year are free from frost; there is little rain. Maximum snow load assumed for designs was 100 kg. per sq. m. (about 20 lb. per sq. ft.), and maximum wind velocity 24 m. per sec. (about 55 mph.).

Character of soil and its carrying capacity were determined by a Russian woman geologist-engineer, Mme. Pokrovskaya, whose report was translated by an Ebasco engineer. Accompanying the report was a novel form of isometric diagram, showing soil sections in planes of borings. Soil consists of clay stratum 1 to 3 m. (3 to 10 ft.) thick underlain with a decomposed rock. Safe loading was determined as 2.5 kg. per sq. cm. (2.5 tons per sq. ft.). Depth of ground water is 10 to 11 m. (33 to 36 ft.).

Climatic Factors

Because of the rigorous climate it was instructed that plant should be fully housed—contrary to recent Ebasco practice in U.S.A., where boilers and other equipment have been installed outdoors. Fig. 1 is from an architect's sketch showing outside appearance of plant. It was directed that general outlines of building be drawn up, with clearance dimensions, but that detailed structural design and architectural treatment be left to the Russian engineers, familiar with materials locally available. Reinforced concrete was used extensively, to conserve structural steel; brick was to be used for walls. With this combination of conditions, instructions were given that Ebasco should design the building from the foundations up to a point required to permit installation of equipment, details of superstructure being left as above stated to Russian designers.

With exceptions noted above, design of building and plant was substantially in accordance with modern American practice, including welding of high-pressure steam piping, selection of instruments and many other details. In general, it was recognized by all concerned with the project, that a plant designed with full freedom to select equipment suitable for the conditions, so as to obtain best possible results, would differ in some respects from the layout dictated by equipment available on short notice, and by other special requirements.

Plant was destined to serve a single industrial establishment. No transmission connection was to be made until some time after initial operation, so that the station had to be completely self-starting from "cold".

It was stated that approximately one-third of the plant operators would be women, requiring provision of separate toilet and locker rooms and rest rooms.

Steam Generators

Main boilers burn pulverized lignite or brown coal, carrying 3,800 cal. per kg. (6,800 B.t.u. per lb.) as major fuel. Also to be utilized are two types of waste gas produced in the industrial plant. Separate burners are provided for each of the three fuels used. Three integral-furnace units were assigned by War Production Board to this development. Two of these had been built for a utility plant in Maine, each with a rated output of 52,000 kg. per hr. (about 115,000 lb. per hr.), with lignite fuel. Third unit, originally purchased for a plant in Florida, is rated 66,000 kg. per hr. (145,000 lb. per hr.). All three units will produce steam at superheater outlet at a pressure of 46 kg. per sq. cm. (650 psi.) absolute, and at a total temperature of 400 deg. C. (750 deg. F.), with feedwater at 160 deg. C. (320 deg. F.). If boilers could have been selected—instead of assigned as available, not over two units would have been used.

Turbo-generator assigned to the development was a 25,000-kw. 0.8-pf., 31,250-kw. 1.0-pf. unit, originally destined for a station near Dallas, Texas, with design steam conditions of 665 psi. absolute 825 deg. F., or in metric units 47 kg. per sq. cm. absolute, 440 deg. C. Some thought was given to derating the steam conditions to a Russian standard—29 kg. per sq. cm. (410 psi.) absolute and 400 deg. C. (750 deg. F.) but it was found that, with required reduction in speed from 3,600 to 3,000 rpm., to fit the Russian frequency of 50 cle. per sec., capacity would be cut below the point desired. Steam conditions finally adopted as a compromise were about 43 kg. per sq. cm. (610 psi.) absolute and 400 deg. C. (750 deg. F.). Generator is cooled by hydrogen, but because of difficulty in obtaining pipe and fittings to fit Russian standards, it was necessary to send American bottles for preliminary use—these to be replaced when adaptors for Russian bottles are made. The double-pass condenser has 2,040 sq. m. (22,000 sq. ft.) of cooling surface. It was originally intended for a power station to serve an aluminum plant in Arkansas. Cooling water is to be from spray pond, circulated by pumps with combined rating of 1.6 cu. m. per sec. (57 cfs.), with make-up pumped from a river about 7 km. (4 mi.) away.

Turbine is bled at three points for feedwater heating, in closed low-pressure heater, deaerating open heater, and closed high-pressure heater. Evaporator supplied with high-pressure bleed steam provides make-up, the vapor being absorbed in deaerator. Overall heat rate is figured at about 3,900 cal. (15,500 B.t.u.) per kw.-hr. net output, as shown in heat-balance diagram, Fig. 2.

Starting from Cold

For starting plant prior to transmission-line interconnection, an auxiliary boiler is provided, rated 13,600 kg. (30,000 lb.) per hr. at 17.5 kg. per sq. cm. (250 psi.), and burning lignite in lump form on an engine-driven stoker. This boiler is first filled with water by hand pump, and is then started up and operated with hand firing until pressure is sufficient to run auxiliaries. First a reciprocating boiler feed pump is started, then a steam-driven forced-draft fan, and finally the stoker. When full pressure is reached, steam is used to run a 760-kw. house turbogenerator at throttle conditions of 15.8 kg. per sq. cm. (220 psi.). During cold weather, steam extracted from house turbine, as well as exhaust from steam-driven boiler auxiliaries, can be used to heat building. Exhaust from house turbine is connected with main condenser. When full output from house generator is available at auxiliary bus, one of the two smaller main boilers may be started, and then main turbine. Remaining high-pressure boilers cannot be operated until main generator begins carrying load.

New Plan for Financing Installment Sales of Appliances

Bank furnishes funds for financing installment accounts by taking over sales contracts without recourse thus utility avoids tying up money in sales operations—Utility does the bookkeeping and makes collections; maintains all usual customer contacts

L. A. MAYO, Connecticut Light & Power Co., Hartford, Conn.*

SINCE 1922, the Connecticut Light & Power Co. has been actively engaged in merchandising electric and gas appliances, selling them either on open accounts or on installment accounts. Appliance sales increased from a modest beginning to a pre-war gross volume of about $2,000,000 annually. War-time restrictions in appliance production, as well as in installment credit, resulted in the reduction of the number and amount of installment accounts on our books to the lowest point in many years, which makes this an opportune time to adopt a change in policy.

Few financial houses offered plans for underwriting installment accounts when the company started selling appliances. The funds had to be furnished by the company and, as the merchandising programs expanded, more and more funds had to be provided.

A Banking Function

The company has always believed that furnishing funds for this purpose was a proper function of banks, but there were difficulties in bringing that about. It was desirable for the company to preserve all customer contacts. If the company had discounted the installment paper in the normal way, which could easily have been done, those contacts would have been removed and the contingent liability would have had to appear on the books of the company.

In cooperation with the Hartford-Connecticut Trust Co. of Hartford, a new plan for financing appliance installment sales was developed. This bank, a leading one in the state, operates seven branches in our territory. The company will use the plan in its 27 district and branch offices, serving about 203,000 customers. These offices cover 107 communities served with electricity and 30 localities with gas, having a population of approximately 703,000, according to the 1940 Federal Census. The installment sales to be financed will include those to domestic, commercial and industrial customers, and similar sales made by dealers and discounted by the company.

Objectives of the Plan

The plan has unique features which will achieve several highly desirable objectives and simplify its operation. The bank will purchase the accounts *without recourse*, so the company's balance sheet will not need to show a contingent liability. This feature is an innovation and gives the company a distinct advantage not generally provided for in other financing plans. It will take the company out of the financing field, with the bank assuming this function. Raising merchandise capital periodically will not be necessary as such funds will be automatically furnished when sales programs are expanded.

The company will retain full control of its merchandising policies and will be entirely free to develop this business. The company will act as the bank's agent, without compensation, in bookkeeping and collection matters, eliminating duplications in this work, which will result in a low operating cost for the plan. The company will retain the advantage of dealing directly with its customers as heretofore, so that satisfactory relations will be continued.

The agreement executed between the company and the bank will cause only minor changes in the company's accounting procedures with no increase in expenses. The company will establish the installed prices of appliances, minimum and maximum terms, amount of financing charges, approve credits, and collect down payments. As sales are made they will be set up in the company's accounts receivable and billed to customers. At the end of the month, the bank will purchase *without recourse* the balances of all new agreements made that month, at face value less a small percentage as a reserve for uncollectible bills. This reserve will be the sole property of the bank and will be used to absorb bad debts.

Payments to Bank

The original sales agreements will be assigned and delivered to the bank, which will have five days to purchase or re-assign them to the company if the bank elects not to purchase. The company will be responsible for all payments collected for the bank until such funds have been paid to them. Payments collected will be deposited locally with company funds. All monthly collections will be paid to the bank not later than the tenth day

* Supervisor of Local Accounts.

of the next month. The company will pay to the bank, within five days from receipt of their invoice, a monthly financing or interest charge at a pre-determined rate based upon the average daily balance outstanding on these accounts during the previous month.

Uncollectable Balances

Thereafter, until such agreements are paid or otherwise liquidated, the company will perform all bookkeeping work; show on its service bills the monthly installments due; answer customer questions; and follow collections. The company is authorized to take whatever collection action may be deemed advisable, including the institution of proceedings to repossess appliances.

The company is also authorized to determine when balances become uncollectable. The bank will reduce its outstanding balance by such amounts, charging them against the reserve. When six monthly installments are unpaid, the entire balance of those accounts will be presumed to be uncollectable. Obviously, it will be in the company's interest to minimize this possibility. The bank will be advised monthly of balances which have become six months delinquent. The company will remit to the bank all amounts received on accounts previously reported as uncollectable, which amounts will be credited by the bank to the reserve.

Quarterly reports will be furnished to the bank by the company, showing for each agreement; its number, date, purchaser's name, amount paid by bank, balance due, amount delinquent if any, and the period of the delinquency. As the volume of accounts increase, preparing such reports might mean considerable work, but these operations will be simplified by the use of punched cards and tabulating machines.

Repossessions

In cases where it becomes necessary, because of delinquency, to repossess appliances from customers, it will be done either by the company or by the bank at the company's option. If the company repossesses appliances and desires to own them for purposes of resale, it may do so by paying the bank the pre-determined value of such appliances, as set forth in a formula in the contract, based upon the depreciated value of the appliances in question. Otherwise, the bank may repossess such appliances and own them and the company has nothing to do with it.

Can Buy Contracts Back

If requested, the bank agrees to sell to the company for the amount of the unpaid balances any agreement it has purchased, returning the original agreement upon receipt of payment. The purpose of this provision is to enable the company to deal with its customers at all times in a manner best suited to maintain good public relations. Some customers will want to return appliances because they can no longer use them, and will wish to be relieved of the commitments made. Others will want to exchange appliances, before full payment, for larger or newer models. Then too, collection action may lead to new credit terms with customers before such time as six monthly installments are unpaid. For these reasons, the company has the right to purchase such balances from the bank and to re-sell them later under new agreements. The bank will also re-assign and deliver to the company the original agreements when accounts are paid in full or when they become uncollectable.

When discounts are allowed for full payments before maturity dates, these amounts will be absorbed by the company because the company benefits when such outstanding balances are paid, as it no longer has to pay a financing charge. Credits or adjustments allowed customers for policy reasons or because of defective appliances are to be absorbed by the company and the bank held free of such arrangements.

Examinations of Records

The company will furnish the bank such additional reports as may be required by the Bank Commissioner of Connecticut. The company will also furnish the bank, annually, a certificate from its public accountants showing the result of their examination of the balances, or a report concerning the efficiency of the company's system of internal control relating to such balances. The bank will be permitted to examine the records maintained by the company at any reasonable time. The agreement made between the company and the bank will be subject to review upon written request of either party. The agreement may be cancelled upon three months' written notice but, if cancelled, all terms and conditions shall remain in force with respect to transactions occurring prior to the cancellation date.

Attractive Financing Charge

From this brief description of the plan, it will be noted that the bank will have little bookkeeping to perform, which enables the bank to name an attractive financing charge. The plan will be started at an early date and no difficulties are anticipated in its operation. This plan goes a long way toward solving one of the problems that has arisen in connection with the merchandising business, namely, the provision of funds to finance such transactions, which under the new plan will be furnished by the bank whose proper function it is. At the same time, it preserves for the company the contracts with its customers who will continue to do business in respect to sales with the company, the same as heretofore. The amount of bookkeeping and collection work to be done by the company will be practically the same as under the old arrangement whereby the company furnished the funds to finance installment buying.

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Germans Supplied Power For Allies Invasion

An invasion assisted by the Germans has been revealed by the Army. This freak of war has been removed from the military secret list and is reported by the Herald-Tribune (New York) as follows:

"On the first night of the invasion of southern France, the Americans plugged into the Nazi power system and lighted the beach with electricity supplied by a German-operated plant fifteen miles away. The Army thought this was too good to be true—getting enemy electricity to light their way into France—and that the Germans would promptly cut it off. But for some reason the Germans kept on for three weeks pumping electricity into American installations. In that period nearly one-third of the electricity which lighted and powered the Allied invasion was furnished through the courtesy of the German Army."

F-M Carrier Telephone Applied on 230-Kv. Line

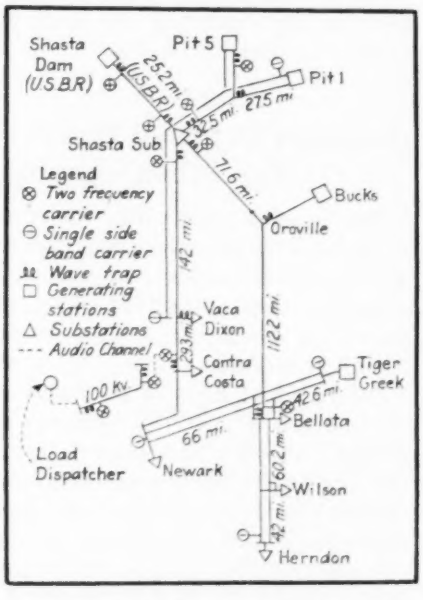
First F-M carrier is installed on Pacific Gas & Electric 230-kv. Pit line—Field tests confirm higher signal-to-noise ratio and other predicted advantages of frequency modulation for transmission carrier

E. W. KENEFAKE, General Electric Co., Schenectady, N. Y.*

FIRST APPLICATION of F-M carrier telephony to power lines has recently been made on one of the Pit 230-kv. lines of Pacific Gas & Electric Co. This provides duplex, or ordinary telephone-type communication, from newly completed Pit 5 powerhouse to Contra Costa substation, a distance of 218 mi., and forms a link in dispatching channels between Oakland and a chain of hydro generating stations and several major substations.

Wartime power requirements have greatly expanded the use of carrier to provide, with reliability and minimum of material, the varied communication services essential to successful operation of power systems. In this case it was desired to provide that type of communication service over a fairly long line on which a high noise level existed due to corona. These were the principal factors which influenced the choice of F-M.

* Carrier-Current Engineer, Electronics Dept.



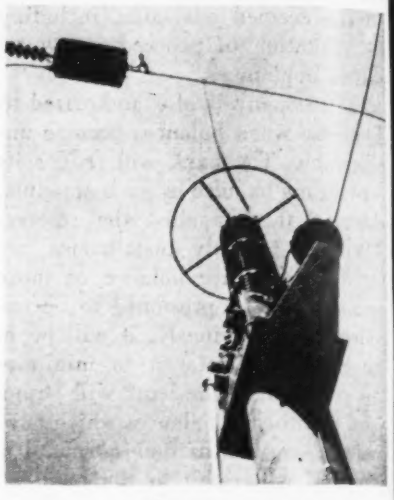
PRESENT F-M CHANNEL extends from Contra Costa to Pit 5. This will be broken at Shasta by installation of two more F-M sets. Shasta then becomes a carrier switching station through audio coupling. Thus carrier circuits will be made to conform to the power flows under several possible operating combinations of transmission lines on the Pacific Gas & Electric system

F-M Development

It has been shown[1] that F-M at low carrier frequencies was superior to A-M when noise was a problem. It is entirely unlike broadcast F-M which takes a wide band and is used with frequencies around 40 megacycles. At the lower carrier frequencies a narrow swing of the carrier is used and a one-to-one deviation ratio is defined as 100 percent modulation, so that the band width required for F-M carrier is no greater than for A-M. This is done because it is desired to have intelligibility with the minimum band width permissible.

Band Width

Band width is generally at a premium due to the characteristics of coupling circuits which involve the coupling capacitor and line traps inserted in the power line to block the energy from unwanted sections of the power line. Another factor in keeping the band width small is the number of permissible carrier channels that can be used on a given section of line. More channels can be obtained when each one is fairly narrow in band width instead of quite wide. For instance, in broadcast F-M the band width used by one transmitter is wider than the whole carrier band from 50 to 150 kc. and even the band width of emergency F-M radio equipment is approximately one-third the complete carrier band of 50 to 150 kc. With the line-traps and the coupling circuits designed for a band width of 6 kc. it is apparent that the techniques of F-M carrier-current must differ from those of F-M space radio.



ONE of the 230-kv. coupling capacitors with radio frequency line-trap shown above. Trap is tuned to offer high impedance to frequencies of 85 kc. and 125 kc., the two carrier frequencies used in the duplex F-M system

The carrier channel on the Pacific Gas & Electric system from Contra Costa to Pit 5 was about 218 mi. long at 230 kv. Most of the line has been in existence for many years and the conductor has a very rough surface which gives rise to considerable corona. Interphase coupling, which utilizes two-phase conductors as a pair

[1] "Frequency Modulation for Power Line Carrier-Current," E. W. Kenefake, *AIEE Transactions*, Vol. 62, Oct. 1943, p. 616.

wires of a transmission line, was ed to minimize line attenuation and oise level. The actual line attenuaon on this 230-kv. circuit was rather w compared to other lines which ave been checked by carrier transission, but the noise level was exemely high.

Line Traps

Two-frequency line-traps were prooided at both stations and at all taps hich might be switched onto the Pit -Contra Costa line as shown by the ccompanying diagram. These linetraps were undoubtedly of greater alue to the channel than the interhase coupling because they minimized the loss of signal between the wo remote ends as well as to block oise arising from the tap lines.

The carrier equipment itself prorides two-frequency duplex communiation and utilizes one carrier frequency in one direction and another arrier frequency in the opposite direction. In this particular channel, 5 kc. was used from Pit 5 to Contra Costa and 125 kc. from Contra Costa o Pit 5. Chief advantage of this system is the ease of communication made possible, since the channel is exactly like a trunk line telephone channel and can be connected to metallic circuits or other carrier channels. There is no switching of the direction of communication as is necessary when a single frequency is used.

Noise Tests

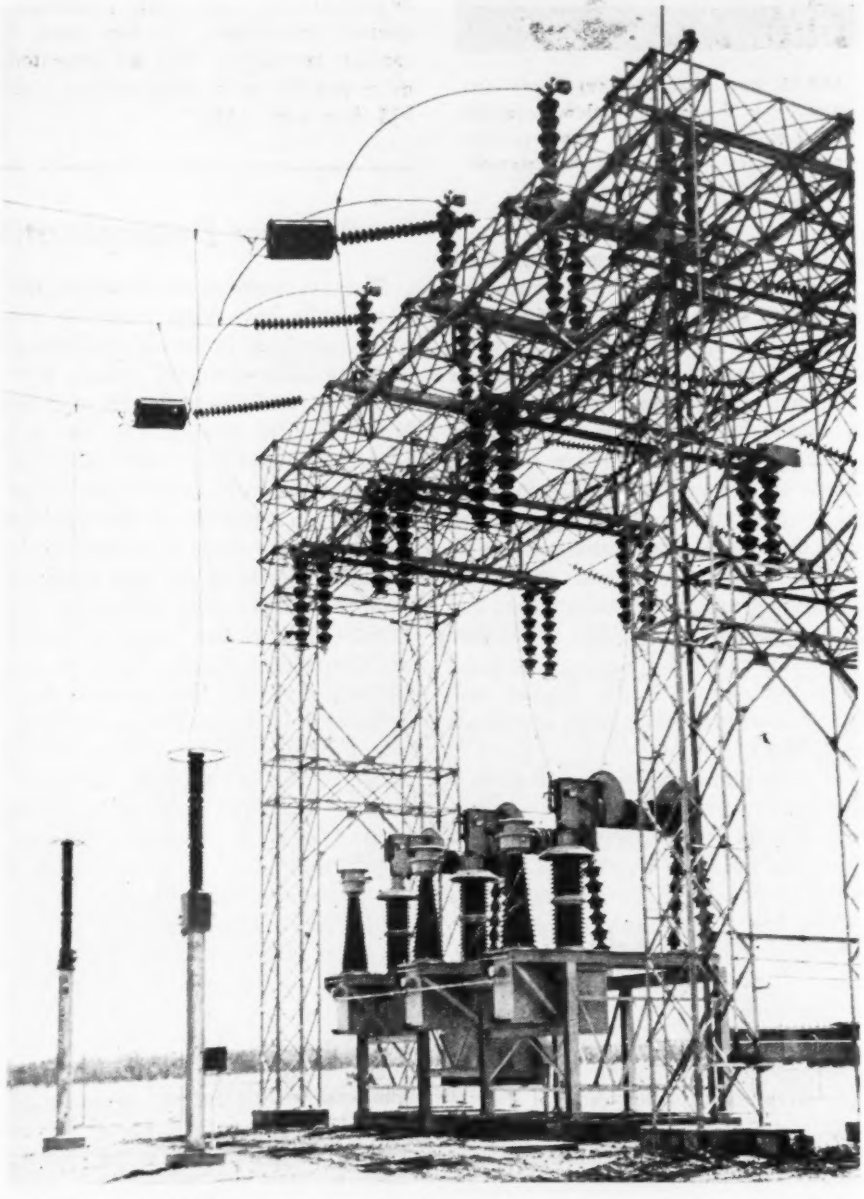
After the sets were completely installed and a communication channel established, which followed the tuning of the line-traps, carrier sets and coupling circuits, various test data were accumulated on the signal-to-noise ratio of FM versus AM, versus single-side-band AM. The data are rather involved and since many readings were taken which varied between certain limits due to the variation in noise level from time to time, only the average results are significant.

The theoretical noise reduction of single-side-band over double-side-band AM was checked very closely and the average on an equal power and band width basis was about 4.4 db. as against a calculated gain of 4.8 db. in signal-to-noise ratio of single side-band over double side-band AM. Comparisons of FM and AM on an equal power basis indicate FM was superior to AM by about 12 db. and the data varied from 9 to 16 db. In other words, on the average, the signal-to-noise ratio on FM was about 32 db. while signal-to-noise ratio on double side-band AM was about 20 db.

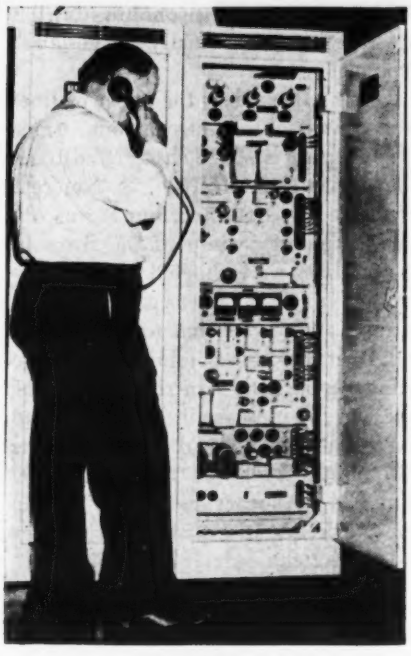
Corona Factors

It should be pointed out that there are two basic kinds of noise on power lines. One is the radio frequencies arising from electrical disturbances such as corona, and the other is corona modulation, which is amplitude modulation of the carrier due to a variable attenuation phenomenon caused by corona. In these tests, and at the carrier power levels used, the major portion of the noise was of the former type. Laboratory tests had indictated that F-M superiority over A-M would be more pronounced if the noise had been primarily of the latter type.

During these tests the effect of line-traps was noted at various times when certain line switching conditions shorted out the traps. No concrete evidence was obtained, but it was observed that if certain of the traps in the tap lines were shorted out the communication channel was changed from a good one to one that was very difficult over which to communicate. Two things apparently contributed to this, one was the increase in noise level and the other was loss of energy in the side bands. This was true of both AM and FM. Another important reason for the frequent use of line-traps was to restrict the carrier frequencies in-



INTERPHASE COUPLING capacitors and line-traps at Contra Costa end of F-M carrier channel. Breaker shown is of the three-cycle impulse type



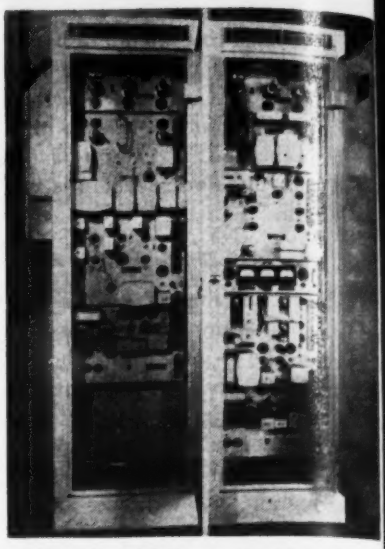
LEADS from coupling capacitors run directly to this station cabinet containing F-M transmitter and receiver. Operator is testing the circuit by listening-in on telephone hand set

so far as possible, without three-phase line traps, to the particular power line involved, so that on the system as a whole carrier channels could be placed closer together in frequency and hence more channels would be available for communication service.

Along with the signal-to-noise measurements, data were taken on methods of coupling for line loss comparisons and noise level observations. For instance, it was observed that with phase-to-ground coupling, line loss was approximately 6 db. more than for interphase coupling, and the noise level was about 2 db. higher with phase-to-ground than with interphase coupling.

Future plans for communication on the Pacific Gas & Electric power system call for carrier telephone channels between Contra Costa and Shasta subs, Bellota and Shasta subs, Pit 5 plant and Shasta sub, Shasta Dam and Shasta sub, Contra Costa and station X, Oakland, and thence with audio metallic circuit to the system dispatcher's office in Oakland. All these are to be provided with the two-frequency duplex type of carrier equipment with interconnection of channels permissible at Shasta sub and Contra Costa sub. At these points the carrier channels can be connected to any of the company's physical telephone lines. With two-frequency equipment and this layout of channels the whole system will be served by fast and reliable communication.

It is definitely planned that the two channels between Contra Costa and Pit 5, with a repeat point at Shasta sub, will be FM. This covers that portion of the 230-kv. lines which have high corona loss. While the two-frequency type equipment uses twice the number of frequencies as do single-frequency sets, their signals go between two points instead of several and hence can be lower in level and restricted by traps more conveniently to a smaller part of the system. Therefore, with a given type of equipment the average frequency spacing of several frequencies can be closer with two-frequency than with single-frequency equipment. In any case, a carrier frequency can be repeated more readily on a given system with FM than with AM.



CONTRA COSTA is terminus of two carrier telephone channels, one, the new FM to Pit 5 (right), and the other (left) an AM to Oakland. The two will be audio coupled, both being duplex systems. Length of combined carrier circuit will be 247 mi.

Review Determinations of Electrical Units

Measurements on the absolute electrical units have been made by improved methods in the national standardizing laboratories of France, Germany, Great Britain, Japan and the United States during the last ten years, and, although very different methods were employed, differences between the results in the various laboratories were comparatively small. Analysis of the data obtained in these laboratories made by Dr. H. L. Curtis of the National Bureau of Standards indicates that the unit of resistance, the international ohm, as maintained at that Bureau in Washington is 494 parts in a million larger, and the unit of voltage, the international volt, 332 parts in a million larger, than the respective absolute units: from these two values, those of the other electrical units may be readily obtained. It is also noted that the electrical units maintained at the other national laboratories are approximately the same as those maintained at the National Bureau of Standards.

Redetermination of these values was found necessary because of marked advances in technical knowledge and new methods of dealing with the electrical units which have gradually come into use since 1893 when the International Electrical Congress at Chicago adopted the international electrical units, units which have been universally used since that time. As an example, an accuracy of one part in a thousand was then considered adequate; now one part in a million is sometimes important.

Because it seemed sufficient 50 years ago to establish these units by indicating a suitable property to be measured and desirable to describe methods by which they might be established in any well-equipped laboratory, the definition of the international ohm contains a statement concerning the mass and length of the uniform mercury column required to give a resistance of one ohm and that of the international amp. the rate of deposition of silver from a solution of silver nitrate. However, so many variations are now known even in the most fundamental properties of a material that the establishment of a standard unit by reference to a property is not entirely satisfactory.

The values now established, which represent an analysis of all known determinations during the past ten years, place the absolute electrical units on a basis which reflects the improved methods and advances in technical knowledge of the last half century.

Repairing Top Heart Rot of Standing Poles

Heart rot in the top of standing western red cedar poles is removed and the hole filled with a pentachlorphenol-fly ash paste to prevent further decay

B. J. BARMACK, Commonwealth Edison Co., Chicago, Ill.*

INVESTIGATION of the condition of tops of standing western red cedar poles in the plant of the Commonwealth Edison Co., in 1942, disclosed that some of these poles had heart rot. Later that year 212 poles were inspected, and the average dimensions of heart rot measured. Width was found to be from 4¼ to 7½ in.; depth from 12 to 27 in. Wall thickness of the remaining good wood was on the order of 1½ to 3½ in. Ages of poles under investigation varied from 8 to 25 years, though most of the decayed poles were in the 11-18 year group.

To repair this heart rot damage and check its further progress in pole tops a treatment was subsequently developed and used, the cost of which is very small compared with the cost of premature replacement of poles.

* Senior Engineer, Equipment Section, Engineering Department.

Procedure of treatment is as follows:

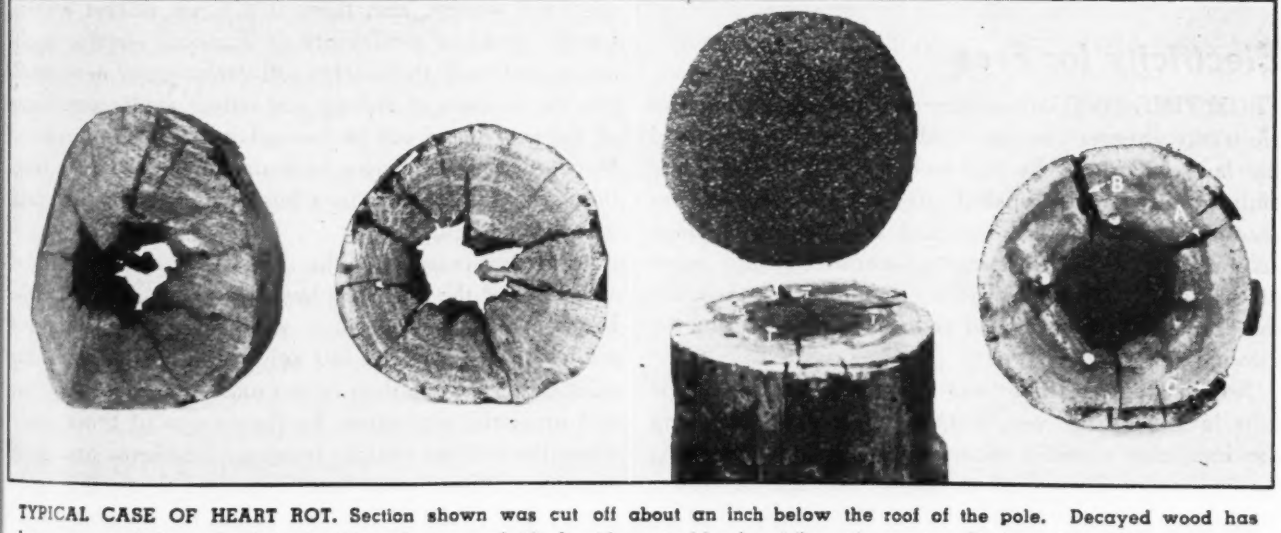
1. Top of pole is cut off flat about 1 in. below the roof to expose the decayed heartwood.
2. Decayed wood is removed, as far as practicable, to expose sound wood.
3. From one pint to about one quart of pentachlorphenol, depending on the size of hole, is poured into the cavity to treat the wood surface and whatever decay may remain.
4. A paste, made of fly ash and a five percent pentachlorphenol solution in fuel oil is prepared for filling the pole cavity. This paste should be sufficiently thick but still thin enough to allow pouring it into the cavity which is filled to the top.
5. Four or five roofing nails are partly driven into the pole top surface around the filled hole and about ½-in. from it. These nails should protrude about ¼ to ⅜ in. to prevent contact of the roofing paper with the paste because the oil in the paste will attack the asphalt in the paper.
6. A piece of 90-lb. slate surfaced roofing paper, cut to the diameter of the pole, is nailed to the pole with roofing nails spaced about 2 in. apart.

The treatment of pole tops in this manner was begun in September, 1943, and applied to 211 poles, of 248 poles ordered to be treated during the fall. Several poles were found to have excessive decay or were badly splintered; only four percent of poles could not be treated for the reasons given. During the summer of 1944, 126 poles were given the preservative treatment.

The cost of material used in the treatment is about 20 cents per pole; labor, including supervision and transportation, is $8.80, making a total of $9.00 per pole.

Thirteen months after the first pole top treatment was applied borings were taken about 6 in. from the top of the pole and tested for the presence of pentachlorphenol in the heartwood. On checking the inner ½ in. of the borings, it was determined that heartwood contained as much as 0.36 lb. of dry pentachlorphenol per cu. ft. of heartwood.

These tests showed the penetration of the treating solution into the heartwood and its movement toward the surface of the pole. It is believed that there was enough of the preservative to last a very long time, and there will be no further progress of decay.



TYPICAL CASE OF HEART ROT. Section shown was cut off about an inch below the roof of the pole. Decayed wood has been removed from the hole in this pole top and filled with pentachlorphenol-fly ash paste. Pockets like "A" should be enlarged and filled but it is not necessary to fill pole check "B" which is ventilated. Decayed and loose sapwood "C" should be removed. Roofing nails around hole prevent contact of roofing paper with oil in the paste

Editorials

S. B. WILLIAMS, *Editor*

Magic Oil

IF YOU WERE A CUSTOMER dropping in to gripe about your bill to the customer's man at the Interstate Power Co. out in Dubuque, Iowa, about the first thing you'd see, after he gets done smiling you to a seat, would be a little cruet labeled "Magic Oil" reposing shyly on a corner of his desk. But don't worry, he isn't going to sell you any or even anoint your head with it. It's there for his benefit—and, incidentally, yours. It's only No. 20 cylinder oil, the kind you put in your car to keep the pistons happy, any old oil with this difference, there's perfume in it to make it smell—ah, ah! Like a posy bed, instead of a garage. What's it for? Just to remind this customer's man that courtesy, kindness and a smile mixed with the oil he spreads on troubled waters can change the whole complexion of things and leave a pleasant aroma with the customer.

The idea so appealed to us we thought we'd pass it on to other companies that are having a difficult time teaching complaint clerks that their job is to make friends out of irate customers.

Electricity for Free

FROM TIME TO TIME one hears of new schemes to make electricity cheaper for everybody by repealing some of the laws laid down by our technical ancestors. Those eminent forbears established principles of energy conservation which have been hard to dispute let alone refute. Nevertheless the perpetual-motion inventor never gives up. Even if he is more orthodox, there is often the promoter or news hound at hand to give play to the astounding discovery.

Not so long ago there was a proposal to cut electric bills in two by the very simple expedient of chopping the inevitable sinusoid along the median line sending the upper (positive) half to one circuit and the lower (negative) to a different circuit. The lamps on these circuits would, of course, not be aware of the trick that had been played on them. Their filaments would stay just as hot and give off just as much white-hot light as if they had been served a heating impulse 120 times in a second instead of the 60 half-cycle pulses. They just wouldn't miss the omitted pulses, maybe. Similarly specious reasoning would probably account for motors torqueing away blissfully ignorant of the shoddy trick.

Possibly these enthusiasts have something very useful and if it ever approaches the halving of "light bills" they will deserve all the plaudits of the whole country. But there certainly should be some authentic fount of information to which newsmen could refer these grandiose assertions and have them debunked before they reach the public press and stir up senseless expectations.

REA Muckraking

THE RESIGNATION of Harry Slattery, administrator in name but not in fact, from REA is not expected to bring peace to the Rural Electric Cooperative Administration while under the Department of Agriculture. In fact, it looks as though REA and some of its officials and even some of the co-ops might be subjected to considerable muckraking until such time as Congress drops its indifference toward the report of the Senate REA investigating committee and decides to accept or reject the recommendation for a separate agency apart from Agriculture.

At any event, this muckraking isn't going to help the extension of rural service any, and for that reason the atmosphere should be cleared quickly and a decision made one way or the other. Thousands of farmers will be delayed in getting service just so long as Congress procrastinates. It has plenty of evidence now to decide.

Service Responsibility For Domestic Appliances

GENERAL OPINION SAYS, and is borne out by numerous local surveys, that there is a large market waiting for the post-war availability of domestic electric appliances. Inevitably this market will attract many newcomers into the business of making and selling appliances. Some of the newcomers will be "in-and-out'ers", less burdened by conscience than driven by desire for profit. Also, from the ranks of the newcomers business mortality will take its toll soon or late.

After the scramble of the immediate post-war market subsides and the appliance business settles down into the hands of responsible makers and dealers producing and selling quality goods at fair prices, the customers of the utilities will have in their homes some quantity of inferior and orphaned appliances. To the owners of these appliances the utilities cannot, in clear conscience and good sense, say, "You bought them; you own them; it is up to you to keep them in working shape, if you want to get from them the use you expected".

It was pointed out in a previous editorial in this maga-

zine (December 9, 1944) that the utility does have responsibility for electric service beyond just the supply of kilowatt-hours. That responsibility does not, should not, impose an undue burden of cost on the utility; it includes no obligation to make repairs, either charged for or free. But it does impose on the utility the duty of seeing to it that customers' appliances are kept in satisfactory operating condition, no matter who does the repair work.

This duty should be a pleasant one to the utility for its discharge maintains revenue growth and as well makes good friends for the company. Experience proves the truth of this. Outstanding among utilities that realize and discharge their responsibility for service beyond the entrance switch is Georgia Power. Its service representatives call on residential customers regularly and with no other assignment than to see that everything is working all right. Small repairs and minor adjustments of appliances are made on the spot; larger jobs are routed to the repair shop. Georgia Power started this work to provide employment for salesmen who had nothing to sell; when the war is over, there will be more service representatives and calls on customers made at shorter intervals.

Present indications of post-war government and social trends are that the power companies are going to need every friend they have and can get. There is no better way for a utility to make friends of its customers than to prove that it realizes its responsibility for service.

Charles Felton Scott

A GREAT EDUCATOR, a great stimulator of professional cooperation, a great pioneer electrical engineer passed on this week. It wasn't three men, it was one man—Charles F. Scott, professor emeritus of Yale University, inventor of the "Scott connection," Edison Medalist and father of the Engineering Societies Building. His was the career of a pioneer—first to apply water cooling to transformers, first to present a paper before A.I.E.E. on high-voltage transmission, founder of Westinghouse Electric Club and also of Electric Journal, as president of A.I.E.E. originator of student branches in the colleges and appointer of the Institute's first technical committee, introducer of the first systematic plan for local activities of any national engineering society. In addition to suggesting to Carnegie the idea for an engineering societies building, Professor Scott was the brain-father of Engineering Foundation and initiator of the first survey of engineering education.

Except for some of his engineering work, Professor Scott's energy was motivated by a desire to improve the lot of the engineer. He was a teacher at heart, a quality probably inherited from his college president father. Bring these two characteristics together and it is not altogether surprising that there resulted a leader in the field of cooperation.

In spite of all he had done, for which many honors were heaped upon him, he remained to the end a simple man. His motto was always to use the simpliest tool at hand—in teaching, the simplest explanation—in engineering, the simplest solution—in cooperation, the simplest program and most direct approaches.

One of the last of the electrical pioneers, his contributions to engineering, education and cooperation will enrich the opportunity for engineers for generations to come.

A New Interpretation of Prudent Investment

ALL ALONG we had figured, as had most utility men, that prudent investment meant original cost as a base subject to downward modification if regulatory hindsight detected some expenditures that might better not have been made. It was refreshing indeed to read a recent decision by the Arkansas commission discarding the original cost theory and substituting a liberal theory of prudent investment much more in keeping with the best principles of business economics.

The commission considered the cost of the system as a functioning whole not just an aggregate of parts. In putting the system together the company had to make an investment that had no relation to the original cost. This was the exercise of good business judgment, or prudence, on the part of the company and the commission allowed in the rate base "the amount invested by the company in excess of the estimated original cost of property and facilities because it was found that it today represents existing and functioning values."

This is the kind of prudent investment that typifies most business acquisitions. People don't buy properties for more than they cost just to be able to be philanthropists but in order to create a system that will be more efficient and better able to serve the area. Since it has been proven that the customer benfits both in lower rates and better service, isn't the investment prudent?

That apparently is what the Arkansas Commission thinks and is the kind of interpretation that makes sense. It in no way gives sanction to watered values created by frenzied financing. It merely recognizes the prudent purchase price of properties needed to build a system.

Index Available

Because of paper shortage, ELECTRICAL WORLD's semi-annual index, which ordinarily would be included in the last issue in December, is being printed separately and will be available shortly. It may be obtained by subscribers without charge on request. Address Editor, ELECTRICAL WORLD, 330 West 42nd Street, New York 18, New York.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

FPC About to Start Natural Gas Investigation

The Federal Power Commission is about six weeks away from the first hearings in an investigation which will keep it busier than a Jap Admiral explaining the battle of the Philippines Sea, an investigation which can, unless handled with consummate skill, fritter away months in wrangling and back-alley exploration, especially when opposed on one ground or another by numerous powerful groups.

The investigation, of course, is FPC's full-dress probe of the conservation and utilization of natural gas, a topic so broad and so ramified that FPC's belief that it can and should be completed in a year to 18 months—"If we don't get sidetracked"—seems almost like boasting.

FPC plans to hear everybody and his brother, all of whom will be there if the increasing interest in the natural gas problem which has become evident in recent months is any criterion.

Size of Reserves

One of the problems the Commission will attempt to settle is that of just how much natural gas the nation has in proven reserves and how long it may be expected to last. On the basis of pre-war use, estimates as to the life of proven reserves range from 28 to 70 years. Since the war started, we have been consuming natural gas at a vastly increased rate. As long as two years ago, the more pressing worry of WPB's power division was gas supply, not electric power. Since that time, at least two states which are big gas producers have balked at indiscriminate exports as prejudicial to their industrial future.

Another thing which FPC wants to determine is how much gas we're wasting. Some estimates that we are "Flaring"—burning at the well mouth—as much gas as we're using. Others estimate this waste at no more than 40 percent; you pay your money and take your choice—nobody knows, but the FPC is going to try and find out.

As if these questions wouldn't keep it sufficiently busy, FPC will consider the problem of utilization. Should natural gas be used as a boiler fuel or should it be reserved for those process industries which would really suffer without it? Is it economic to pipe gas a thousand miles to a vast coal-producing area and, conversely, should millions of dollars invested in gas transmission, distribution and consumption facilities be written off because local supplies are near exhaustion?

Opposition

The American Gas Association and the Independent Natural Gas Association are opposed to the investigation during the war, with the latter taking the position that the matter is so broad as to be beyond FPC's jurisdiction and a fit subject for a congressional investigation. Some important sections of the oil industry are accusing FPC of attempting to grab jurisdiction over the oil business, arguing that so much natural gas is produced in conjunction with oil production that no gas conservation measure could fail to affect oil production. Harold Ickes, who is also petroleum administrator for war, opposes FPC's temerity in instituting such an investigation. He argues that wartime is no time for such matters and, inevitably, that it ought to be done by Ickes, who in addition to being fuels administrator for war, has permanent jurisdiction over the Bureau of Mines and the Geological Survey.

FPC's answer to the war argument is that it's high time to find out the basic facts with relation to natural gas. In addition, it is sick and tired of arguing these broad questions every time some gas company wants to lay two miles of pipe. Under the Gas Act, it is required to hold hearings on every application for a certificate of convenience and necessity. The coal and railroad crowds intervene in many cases seeking to make their contention stick that they are being hurt by gas pipelines. In some trifling cases, intervenors have averaged about one per mile of line sought. FPC is understandably weary of this.

One of the more compelling reasons for an investigation now undoubtedly is the increasing truculence of Louisiana and Texas regarding gas exports, for the situation could rapidly degenerate into the state known to the military as "Tarfu" if either were to legislate against exports and make it stick. Prompt attention to the entire problem now conceivably could head off such legislation.

FPC is now tabulating returns it has had from its invitation to submit views on the scope of the inquiry. In about six weeks it expects to hold a hearing on a tentative program, then compile a final program, after which hearings will begin.

Other Activities to Continue

The investigation will be of direct interest to those power companies which consume natural gas, of course, but the remainder of the industry will be wise not to assume that the project will over-shadow its normal electric utility regulation, for FPC has no intention of halting its other activities to make way for the gas probe. After long struggle, FPC is getting within shouting distance of completion of its original cost work, with companies representing more than one-third of the industry's assets having filed acceptable original cost studies, and those representing more than half the industry's assets substantially complete. Two to three years' work on the remainder after the war should complete the job, FPC feels. Write-offs by the 80 companies which have "been through the wringer" total about $500,000,000.

Furthermore, let it not be forgotten that much of the recent precedent for future electric utility regulation arose in the commission's determination of natural gas value and return.

NEWS OF THE WEEK

Citizens Buy Last Private Power Utility in Nebraska

American Power & Light Sells Common Stock of Nebraska Power Co. to Non-Profit Corporation Which Plans Resale to City of Omaha—Council Opposes Sale and Will Begin Condemnation Proceedings

Nebraska Power Co., the last privately owned electric utility in the state, has been purchased by a non-profit corporation organized by three Nebraskans who propose to turn over the utility to Omaha to operate as a municipal system.

American Power & Light Co., a unit in the Electric Bond & Share Co. system and owner of the Nebraska Company, announced December 12, the sale of its common stock for $14,125,000. Total basic sale price will be $40,680,000 with certain adjustments for property additions and current position under a specified formula. The basic price is the same as that offered early in 1942 by the Consumers Public Power District of Nebraska and more recently by Omaha Peoples Power Commission.

The power company with headquarters at Omaha has been a center of controversy for five years between the city and power district authorities which are subdivisions of the state. Bill LB204 passed by the state legislature provided for purchase for municipal ownership by the Peoples Power Commission but that group is enjoined by litigation now being reviewed by the Nebraska Supreme Court.

Knowing of the proposed sale, city council led by Mayor Dan B. Butler voted 6 to 1 on Tuesday morning to adopt an ordinance instituting condemnation proceedings against Nebraska Power Co. properties in the city. Final decision on this will rest with the voters at the regular city election on May 15. City council, however, has until December 27 to reverse itself and call off the election. At the same meeting, council, also by a 6-1 vote, called for a reduction of $1,000,000 a year in power rates in Omaha but made no specific recommendations as to how the rates are to be reduced.

Mayor Butler also sent a telegram to the Federal Power Commission demanding "that all steps be taken to prevent promoters from carrying out this scheme to unload this property on people at exorbitant price."

In reply, Leon M. Fuquay, FPC secretary, wired "concerning reported sale by American Power & Light Co. of its stock in Nebraska Power Co. to three Nebraska men, this transaction would appear to be a sale by a holding company of stock in its subsidiary and, as such, does not require the approval of and is not subject to regulation by the FPC."

Organizers and officers of the new corporation are Bernard R. Stone, Omaha attorney, president; C. Russell Mattson, Lincoln attorney, vice-president; and Sidney J. Cullingham, State Senator from Omaha and a real estate man, secretary-treasurer.

Stockholders will meet December 26 to elect directors. The group headed by Mr. Stone as the greatest holder of common stock will control the election of the majority of new directors. Proposed directors, all members of the Omaha Peoples Power Commission, who have indicated their willingness to serve as individual citizens on the board, are the following Omaha residents, T. H. Maenner, real estate and insurance man; Don B. Woodyard, general manager, J. C. Penney Co.; Edward F. Leary, attorney; Gerald Collins, attorney; and Dr. B. H. Baer, physician and surgeon of Ashland, Neb.; and Emil E. Wolf, North Bend, Neb., banker. Mayor Butler as an ex-officio member of the PPC will also be asked to serve.

In a lengthy 16 subdivision statement defending their purchase of the power company and showing its advantages to Omaha residents, officers of the new corporation affirmed that their plan for purchasing the company and making it municipally owned carries out the spirit of LB204 which has been stifled by litigation.

Briefly the subdivisions of the statement follow:

The question of whether or not the common stockholders of the power company will sell has been settled; they have sold.

The citizens panel appointed by the mayor and council in 1942 offered with the approval of the mayor to buy at a price derived by the same formula.

Same Price Offered Before

The Peoples Power Commission, represented by its chairman and with the approval of all members including the mayor offered the same price derived by the same formula.

Black & Veatch, consulting engineers, appraised the company as being worth several millions dollars more than the formula price.

The $32,000,000 figure set by the Federal Power Commission and which the mayor now claims is the proper valuation was only the original cost figure.

Condemnation proceedings will take at least five years, will cost considerable money and if successful tax revenues of $865,000 a year will be lost.

The new corporation will call and redeem all preferred stocks and bonds and will pay full "redemption premium thereon" so that no security holder, including many Omaha residents, will not lose a cent.

The new corporation will pay city, county, school district and state taxes

assessed hereafter the same as the power company has always done.

Public Power Districts do not aim to acquire electric properties of Omaha but are only aiding general plans of non-profit corporation.

Peoples Power Commission has taken no action since injunction was issued in February, 1944, by District Court of Douglas County.

Legislation will be secured to give Omaha citizens a chance to vote on an ownership and operation plan. The corporation can't sell to anybody but Omaha or PPC.

The corporation will cooperate with Public Power Districts and will coordinate the Omaha steam plant with their operation.

All employees will be retained, and those in service will get their jobs back.

A conference will be held with mayor and council on rate reductions.

City council will always, as in the past, have full power to regulate rates.

The corporation will give Omaha what it needs, peace and time for reconstruction.

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Straight-Line Depreciation Called Ruinous by Banker

Adoption of retroactive straight-line depreciation as recommended by some regulatory bodies would "ruin every public utility company in the country," Edward Hopkinson, Jr., a member of the investment banking firm of Drexel & Co., testified at a recent hearing before the Securities and Exchange Commission.

Mr. Hopkinson, who testified on the depreciation phases of the plan of reorganization proposed by the Niagara Hudson Power Corp. for its subsidiary, Buffalo, Niagara & Eastern Power Corp., also expressed the opinion that it is "not going to happen" and stated that reserves of utility companies were inadequate but were being built up from earnings.

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Cape Fear Power Corp. Chartered in N. Carolina

The Cape Fear Power Corp., with principal office at Wilmington, N. C., has been chartered by Secretary of State Thad Eure of North Carolina to operate electric and other power plants under authorized capital stock of 100 shares common stock, no par value; subscribed stock, $1,000, by J. W. Bunn, Banks Arendell, both of Raleigh, and David H. Jackson, New York City.

Hetchy Power Won't Go to Navy Yards

President of Pacific G. & E. Spurns Ickes Suggestion to Send Electricity over Utility Lines

The protracted feud between Secretary of the Interior Harold L. Ickes and the Pacific Gas & Electric Co. produced a new clash last week when President James B. Black slapped back at the Interior Department with his flat refusal to transmit Hetch Hetchy power to Mare Island and Hunter's Point Navy yards as Secretary Ickes had proposed.

Meanwhile the City of San Francisco was sitting nervously by as ingenious Hetch Hetchy power disposal plans were trampled in the skirmish, and city officials were wondering just how much of the $2,400,000 Hetch Hetchy power revenue they could salvage in face of the rigid Raker Act.

A letter from Secretary Ickes to San Francisco's mayor, Roger D. Lapham, blasted hopes for disposal of all power to irrigation districts of Modesto and Turlock, Calif., a proposal revealed late in November which involved resale of power to the P.G.&E. Two days later, still another of the city's solutions met rejection. Under it, the city would have served the Navy yards (as suggested by Secretary Ickes), would have supplied municipal needs and would have sold the remainder to the irrigation districts.

P.G.&E. facilities would have been used to transmit power, and Mr. Black was quoted as saying the company does not believe it should be asked to transmit power other than its own if such power is to be sold to customers that it is able to supply.

With Mr. Ickes' admonition to the city that, in evolving still another plan, officials not "waste time, energy and newsprint in the fruitless pastime of beating the devil around the P.G.&E. bush", San Francisco fathers were basing hopes on a third plan. Though it would mean a revenue loss to the city of about $500,000 annually, it is construed to be "at least a 79 percent" compliance with the Raker Act.

Under its terms, the city would use 46 percent of the power, sell the irrigation districts 33 percent for their immediate use, and form a reserve of the remaining 21 percent with the hope the districts could eventually market it to industries.

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Veterans Given 90 Days to Reclaim Old Positions

Veterans of the present war will be allowed 90 days in which to claim the jobs they left to enter the armed services under an act signed last week which amends the National Selective Service and Training Act of 1940.

Under the original act, veterans were allowed 40 days in which to apply for jobs they held immediately prior to their entry into the armed services, whether through induction, by enlistment or by call in the case of National Guardsmen, reserve officers or members of the inactive reserve.

Under the law, employers who are able to do so are required to re-employ veterans discharged other than dishonorably at positions at least equal to those they left. The law has been interpreted by Selective Service officials to mean that veterans thus re-employed have a superseding claim on their jobs for one year after re-employment.

TEAMING UP FOR SAFETY—Linemen of Central Maine Power and New England Telephone & Telegraph companies join in a meeting at Lewiston, Me., to get the latest points on the art of climbing. A motion picture was shown by Earl Trott, safety director of the telephone company's eastern division, as a part of the program. Other meetings at which notes have been compared by men from these power and communication utilities have recently been held at seven other urban centers on the C. M. P. system

Future of Private Utilities Depends on 'Common Man'

Business-Managed Electric Companies Now in Excellent Financial Condition and under Intelligent Regulation but Must Get Support of Ordinary Citizens to Avoid Government Ownership, A.I.E.E. Told

With the business-managed electric utility industry in the strongest financial condition in its history and its member companies under intelligent regulation, they can look forward to serving the nation in peace as well as they have done in war provided that they can convince the "common man" that his liberty and happiness depend upon the maintaining of private enterprise.

This collective view of the electric utility industry was given last week by three speakers at a symposium entitled "Horizons for Industry" and conducted by the New York Section of the American Institute of Electrical Engineers. The speakers were Ganson Purcell, chairman of the Securities and Exchange Commission; M. William Bray, New York Public Service Commission; and Gay H. Brown, member law firm of Brown, Ryan and Kenny, New York City.

Industry Financially Strong

The financial strength of the industry was brought out by Mr. Purcell, chairman of the SEC, which up to June, 1944, had passed upon the issuance of more than $6,000,000,000 of securities of registered holding companies and their subsidiaries.

Holding companies in the 1920's, Mr. Purcell stated acquired systems everywhere at inflated prices in the interest of profits and not of the public. Many of these systems were not integrated; some served no useful purpose. SEC was directed to limit holding companies to integrated systems and to dissolve those that served no useful purpose. Companies played a waiting game and their voluntarily submitted plans for reorganization in many cases were merely efforts to maintain their existing organization. Since 1940, SEC has forced reorganization upon them.

"The operating utility subsidiaries of registered holding companies," he said, "wrote down their property accounts by more than $500,000,000 in the seven years ended December 31, 1943. . . . We have also used every legitimate device to reduce debt and establish conservative debt ratios.

"There were gross property additions of nearly $2,500,000,000 and a net increase in plant accounts of more than a billion dollars after allowing for retirements and the elimination of inflationary items. Yet total outstanding debt decreased by more than $200,000,000."

The service companies affiliated with holding companies with their trained technicians can still play an important part after the operating companies become independent. But the operating companies must be free to get services in the open market. Service companies controlled by holding companies must furnish services to client companies at cost. Maintenance and construction programs of independent operating companies will also be freer if not weighed down by an overfinanced corporate structure.

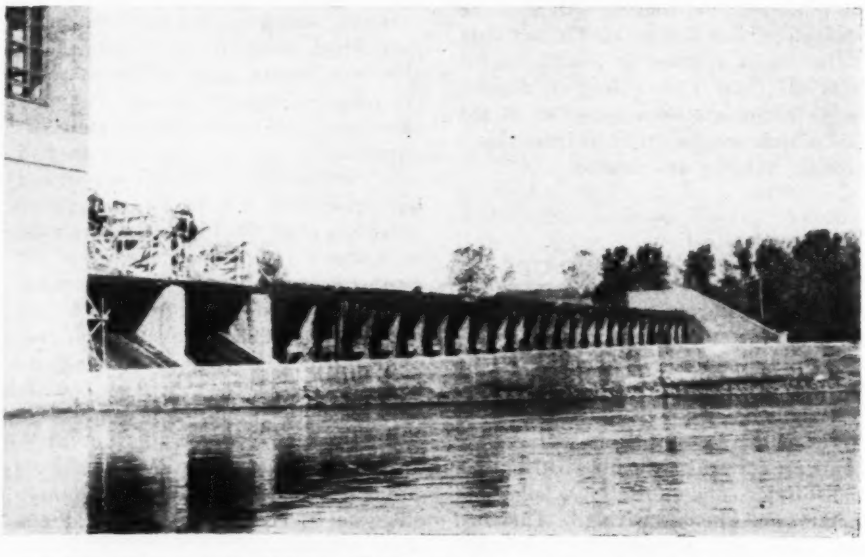
M. William Bray, who is a former lieutenant governor of New York, declared that in the post-war era the utility field will be the proving ground in which it must be demonstrated that the public interests can be protected by legislative, administrative and judicial safeguards, without sacrificing the great human and political values of the free enterprise system.

"It is not in the public interest to permit an individual owner to use his property against public welfare. But by the same token, it is not in the public interest to destroy private property and its fruits. Sound regulation will prevent the anti-social use of private property, but it will also prevent the destruction or impairment of the productivity and usefulness of private property. Looked at from this point of view, private and public interest coincide.

"Industry has certainly contributed and is now contributing a splendid performance in helping to win the war. If industry can rise to these heights in war times, why is it not the part of wisdom to stimulate these efforts in peace time. It seems to me that these facts have established that intelligent regulation is not only in public interest but has proved to be in the interest of industry as well. Now, if intelligent regulation will tend to stop tendencies more hostile to industry than the evils which industry has feared and survived before, then this kind of regulation will prove to be the greatest friend industry has ever had."

Gay H. Brown, like the two preceding speakers, a lawyer, told of the groups which with indefatigable energy and consumate skill are working to win converts to the cause of government ownership. These groups are the demagogues, the collectivists, the Federal Power Commission, and the state regulatory bodies. Of these groups only the members of the last believe in private ownership. But they cannot openly oppose government ownership as the others oppose private ownership.

In answering the question, "What can be done to preserve the private enterprise system in this country?" Judge



TOLEDO EDISON DAM UNDER REPAIR—Part of the improvement program of the Toledo Edison Co. in its Defiance, Ohio, division is the repair of this dam on the Auglaize River, four miles east of Defiance. Built in 1911, the dam is 375-ft. long and 20-ft. high

Brown, formerly of the New York State Supreme Court, advised utilities to render the most efficient service at the lowest rate consistent with that service. But this he said was not enough. They should publicize by advertisement, speaking, and by radio the great accomplishments during the war, and proposals for the future.

"Millions of people are at the present time, utterly indifferent as to whether the government or private owners operate the utilities. If private enterprise is to be preserved, the people of this country must come to understand and comprehend that this movement toward government ownership will destroy the American way of life. The great problem is as to how the American people may be convinced as to the basic issue involved."

The judge said the answer to this problem was to get those groups who people believe have no axe to grind to act in concert against the rampant regimentation which is threatening to engulf this country. These groups, which the speaker said are at least 90 percent in favor of private enterprise, are the physicians, clergymen, engineers, lawyers, educators, editors, news analysts, radio commentators, and labor leaders.

When the "common man" realizes that his happiness, liberty, and well being are at stake, collectivism will be crushed, the speaker declared.

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Springfield, Mo., Must Get Voters Approval for Bonds

Springfield, Mo., may issue $6,750,000 in municipal bonds to purchase the plant and distribution system of the Springfield Gas & Electric Co. but only if the voters approve at a duly called legal election. This ruling of Circuit Judge Kirby has been appealed by the city which wishes to issue the bonds without holding an election.

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Will Study Rural Co-ops

Five standing committees to study problems of rural electrification cooperatives have been established by the National Rural Electric Cooperative Association.

The committees will study farm appliances, transmission and distribution, transformers and substations, poles and meters and house wiring. The last committee will consider the advisability of discontinuing the use of meters and substitution "of such other devices or methods as may be determined appropriate."

Rivers and Harbors Bill Dies with 78th Congress

Senate Recesses without Further Consideration of Conference Report When Faced with Debate on Controversial Elliott Amendment—Bill Allowing TVA Co-ops to Become REA Co-ops Passed by Both Houses

The Rivers and Harbors Bill—which called for expenditure of almost half a billion dollars and authorized power projects with an ultimate capacity of about 1,800,000 kw.—died with the 78th Congress this week when the Senate recessed without further consideration of a conference report on the measure.

Stalled for several days as the Senate treated the country to the rare spectacle of three staunch administration senators fighting the President, the Rivers and Harbors Bill was waved into Limbo when it became apparent that any reconsideration of the vote by which the Senate last week rejected the conference report would result in considerable debate on the controversial Elliott amendment. At 6:30 P.M. six days before Christmas, the Senate was in no mood for further repetition of arguments propounded at length on several previous occasions. The bill was forgotten, and the Senate went home.

Sticking point in the bill was the Elliott amendment, which would exempt California's Central Valley project from the terms of the Reclamation Act which prohibits water service to individual land holdings in excess of 160 acres.

Filibuster Delayed Action

Senate action on the conference report, which restored the "Elliott rider" after the Senate had stricken it from the bill, was delayed by the disagreement over confirmation of six state department nominees. The Senate had once rejected the conference report but was faced with a motion to reconsider its action after the House flatly refused to budge. The filibuster carried out against confirmation of the six nominations was the unfinished business before the Senate, with no action on the conference report possible until the state issue had been settled.

It was pointed out that it was only an authorization bill, providing no funds, and that the agreement on virtually all projects therein was such as to indicate that it could be passed next session without long hearings. Also, a factor was the fact that threats of a veto had been advanced by administration leaders if the measure went to the White House with the "Elliott rider." Interior Secretary Harold L. Ickes has strongly opposed every attempt to circumvent the Reclamation laws and usually has been successful.

In its late drive for adjournment, both Houses approved a bill under which the Rural Electrification Administration may make loans to electrification cooperatives organized under the Tennessee Valley Authority Act and financed by TVA by which such groups could discharge their TVA obligations and become REA cooperatives. The principal point was to consolidate in one agency all rural electrification loans and to allow TVA-financed cooperatives to obtain the longer amortization period and lower interest rate available to REA borrowers under the Pace Bill passed last fall, extending the life of loans from 25 to 35 years and lowering the interest rate thereon to 2 percent. Average interest saving is expected to be 1.5 percent.

REA Gets $696,000

Also approved by both Houses was a deficiency appropriation bill under which REA received $696,000 to be expended in lending assistance in preparation of loan applications and for supervision of work on improvement of REA systems impaired during the war, for re-working designs and completing plans for construction of new REA systems immediately after the end of the European War, and for re-working loan applications for other projects.

The bill provided also for several Reclamation Bureau projects, including $1,045,000 for the Alva B. Adams tunnel on the Colorado-Big Thompson project with two transmission lines to connect with an REA co-op and a municipal system; and $1,900,000 for the Columbia Basin project, to be expended for repair of the spillway bucket on the Grand Coulee Dam. The House refused to accept two Senate amendments which would have made available $400,000 for transmission lines on the Fort Peck, Montana project, and $50,000 for preliminary surveys of the Hungry Horse Dam, authorized last June.

Supplementary funds granted the Engineer Corps for river and harbor and flood control work do not concern power activities.

Connecticut Commission Defends State Regulation

Report to Governor Baldwin Declares that Intrastate Matters Can Best Be Handled on Autonomous Basis Reinforced by Local Background Difficult to Associate with Remote Supervision

A searching analysis of the sphere of state regulation as confronted with Federal supervision has just been presented to Gov. Raymond E. Baldwin by the Connecticut Public Utilities Commission in its report for the fiscal year, ended September 30. Perhaps the most important question and certainly one of the most interesting problems in utility regulation today arise in connection with the above line of demarcation, the board says.

The present law confers upon the Federal Power Commission jurisdiction over the accounting practices of utilities engaged in interstate commerce and the wholesale prices of gas and electricity so transported. Despite the Federal Power Act's preamble against the Federal regulation of practices already under state jurisdiction, the Federal Power Commission has for some years claimed the power to regulate operations which many of the state commissions have felt to be within their exclusive jurisdiction.

FPC Withdrew From Case

The Connecticut commission reviewed at some length the recent proceedings in relation to jurisdiction over the power contract between the Connecticut Power and Torrington Electric Light companies, which has been fully covered by ELECTRICAL WORLD. Connecticut Power Co., as a utility under FPC jurisdiction, informed the FPC as to a new contract (in which a major rate readjustment was made because of fuel price changes). FPC suspended the contract and arranged for a formal hearing upon it although the contract had already been approved by the Connecticut commission after thorough investigation. Following a conference between the two commissions, FPC lifted its order of suspension.

This action, the Connecticut board says, "leaves the matter in the hands of the state commission but does not settle the jurisdictional question which may arise at any time in the future. A state commission, composed of people who live in the geographical area involved, should have a factual background that would enable it, other things being equal, to act more intelligently in the decision of local issues than is possible for any Federal agency, necessarily remote geographically from areas within which a utility operates.

"If, on the other hand," the commission states, "the Federal Government is given jurisdiction, this carries a strong implication of political and economic impotence, confusion and conflict in the realm of local government. It follows, therefore, that there is little hope for the survival of governmental autonomy of the sort that has heretofore been accepted in this country. Such a conclusion establishes a situation in which the next logical step is complete centralization in government, if not a totalitarian economy. Members of the Connecticut Commission are not yet ready to admit the futility of state control and the necessity for the emergence of an all-powerful ubiquitous Federal bureaucracy in the utility regulatory field. They are strongly of the opinion that local state autonomy is something that should not be forfeited."

State Regulation Challenged

Continuing, the commission says, "The strongest argument presented by the advocates of future concentration of power in the Federal Government, as related to the utilities, is the alleged breakdown of state regulation. Regulation, in its very nature, is a dynamic rather than a static procedure. What might have been equitable and proper in the embryonic stage of the utility industry might just as well be inadequate and improper under present conditions. The established criteria in the field of regulation are constantly under review and are in transition comparable to the changes that come in the field of government in general. None the less, state regulation is on trial. The advocates of Federal regulation allege the failure of state regulation in the past. The most effective answer that can be given to these advocates is convincing evidence that state regulation can be effective.

"To make this regulation effective under modern conditions necessitates that comprehensive powers and an adequate staff of experts and technicians be available to the state utilities commission. With a full realization of its responsibilities for adequate regulation, and incidentally as a means of conserving the essence of local state autonomy where practicable, this Commission is now requesting an expansion of its staff and the supplementing of its powers which, in the judgment of the members of the Commission, are essential to the fulfillment of its responsibilities to the public. If the states fall down they have only themselves to blame when a few years hence they discover that the horse has been stolen before the stable door has been locked. This Commission still believes that with intelligence, courage, integrity and the provision of adequate machinery the State of Connecticut is competent to solve the problems arising between owners and investors in utilities on the one hand and customers on the other."

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Public-Private Battle Reopens in Northwest

Heralding an attack on the large interests of the Portland General Electric Co., Northwestern Electric Co., and Pacific Power & Light Co., in Clarke County, Wash., whose seat, Vancouver, is practically a suburb of Portland, the Clarke County Public Utilities Dist. No. 1, at a meeting of its commissioners, December 14, adopted a resolution opening the way for a suit asking condemnation of all properties in the district owned by the three corporations.

D. Elwood Caples, Vancouver attorney, said proceedings would be filed in the Clarke County court. The PUD desires to acquire all properties and operating facilities within Clarke County. They would be paid for through issuance of electric revenue bonds totaling $4,200,000 in $1,000 denominations and payable over a period of 30 years. New York engineers have been making a study of the properties for the PUD over a considerable period.

James H. Polhemus, president of Portland General Electric, said he had no idea of terms of any offer that might be made for P. G. E. properties but expected to receive a copy of the resolution soon. Similar comment was made by T. E. Roach, vice-president and general manager for Northwestern Electric.

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Virginia Power Taxes Up

State Comptroller Henry G. Gilmer has reported that tax payments by public service corporations in Virginia showed an increase for the first four months of the current fiscal year which began July. Power companies turned in $1,614,459.08 as compared with $1,486,292.63 in the same four months of last year.

Metering Protection P.E.A. Meeting Topic

Short Arrester Leads Indicated Desirable by Impulse Tests on Primary Installations

Compensating metering in a revised form and use of indoor instrument transformers in a cabinet with internal lightning protection were prominent topics at a meeting of the Pennsylvania Electric Association's meter committee in Philadelphia on December 14 and 15.

H. N. Ekvall and R. W. Pfaff of the host company told how impulse tests indicated that the arrester had to be connected and located close to the potential transformers. Old and even some new equipment will not stand. Ekvall indicated, the 68 or so kv. with a 5,000 ampere peak surge; lead reactance of some 3 kv. per ft. makes short connections desirable. Conclusion was to install the arrester on the grid on which the primary metering is assembled in an enclosure provided by the customer. Objectives are safety and stability of service.

Cyclometer Meter Not Popular

Inconclusive discussion followed a query whether current transformers are in practice selected on the basis of load current or of capacity to withstand local short circuits. Discussion of the cyclometer meter dial tended to emphasize the objections to the greater friction, proneness to dust accumulation and difficulty in reading unless favorably situated. It was acknowledged that the cyclometer type is more easily read by consumers. Increased interest was manifested in thermal demand meters, especially of the separate type.

Among new equipment shown was a Murray service box with redesigned porcelain terminal block, more clearance and heavier barriers; it is used for A-base meters in Philadelphia in outdoor installations of water-heater and range service.

How completely the watthour meter manufacturers have switched to war work was graphically related by F. C. Holtz, vice president of Sangamo Electric Co. He enumerated several instances of unique solutions of technical matters which insure a new pace in the post-war instrumentation and metering world. Few watthour meters have been required for purely military purposes, possibly due to the lay familiarity with its functioning and potentiality. Holtz did intimate a solution of a 10-kc., 2.3-kv., 200-ampere watthour meter for induction heating applications.

Wants to Issue Bonds

Arkansas-Missouri Power Corp., serving northeastern Arkansas and southeastern Missouri has applied to the Arkansas Utilities Commission for authority to issue mortgage bonds and execute mortgages securing them.

The company is seeking authority to call in and cancel $2,350,000 in 4 percent bonds and re-issue $2,000,000 principal amount of first mortgage 3⅛ percent bonds and to use cash in the treasury to pay the difference.

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H. Slattery Predicts REA Will Be Made Independent

Harry Slattery, who resigned last week as administrator of the Rural Electrification Administration, kept the pot boiling in his feud with Agriculture Secretary Claude R. Wickard this week with a statement that when the latter's "political, illegal maladministration of REA becomes known in detail, it will be repudiated by the American people; and REA will be made an independent agency once more."

Declaring that Wickard beats all Washington bureaucrats, Slattery said the appointment of William J. Neal as deputy administrator with "coordinating" authority in June, 1943, brought to the management of REA "a perfect stranger to REA procedures . . . former president of one of the worst-managed of all of REA's 813 systems . . ."

"Under Mr. Wickard's order appointing this deputy," Slattery said, "no member of the staff could come to see me, or write to me directly. All mail and documents also came to him first. Many important ones never reached me. In adminstration, whether of the government or of private industry, the boss never has to clear it through the office boy."

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Dr. Charles F. Scott Dies

Dr. Charles F. Scott, professor emeritus of electrical engineering at Yale University and nationally known as an engineer and educator, died in a hospital in New York on December 17 in his eighty-first year.

In the course of his distinguished career, Dr. Scott received the highest honors conferred by the electrical industry. He was a past-president of the American Institute of Electrical Engineers and the recipient of the Edison medal awarded by that society and also past-president of the Society for the Promotion of Engineering Education and of the Engineers Society of Western Pennsylvania.

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Utility Valuation Upheld

The disputed $10,500 valuation on the Northwestern Wisconsin Electric Co. utility property at Centuria that the village wants to acquire, was upheld by Circuit Judge Sachtjen in Madison.

The decision upholds the Public Service Commission that fixed the plant value at said figure in July, 1941. The utility appealed. On April 1, 1941 a referendum election approved acquisition of the properties.

MEETINGS

National Rural Electric Cooperative Association—Annual convention, Plaza Hotel and Municipal Auditorium, San Antonio, Texas, January 16-17. Avery C. Moore, secretary-treasurer, 416 5th St., N.W., Washington 1, D. C.

Previously Listed

Dielectric and Induction Heating Conference—Sponsored by Great Lakes Power Club and Chicago Lighting Institute, Marquette Auditorium, 140 So. Dearborn St., Chicago, Ill., January 16-18. C. W. Zersen, Conference Committee, 72 West Adams St., Chicago 3, Ill.

Missouri Valley Electric Association—Annual power sales conference, Continental Hotel, Kansas City, Mo., January 17-18. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln 8, Neb.

American Society of Civil Engineers — Annual meeting, Commodore Hotel, New York, N. Y., January 17-19. George T. Seabury, secretary, 33 West 39th St., New York 18, N. Y.

Canadian Electrical Association — Annual winter conference, Mount Royal Hotel, Montreal, January 18-19. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal 1, Que.

Industrial Electrochemical Conference — Museum of Science & Industry, 57th St. and Lake Michigan Ave., Chicago, Ill., January 19. O. W. Storey, chairman of publicity committee, C. F. Burgess Laboratories, Inc., 180 N. Wabash Ave., Chicago 1, Ill.

American Institute of Electrical Engineers — National technical meeting, Engineering Societies Bldg., New York, N. Y., January 22-26. H. H. Henline, secretary, 33 West 39th St., New York 18, N. Y.

Institute of Radio Engineers — Winter technical meeting, Hotel Commodore, New York, N. Y., January 24-27. W. B. Cowilich, secretary, 330 W. 42nd St., New York 18, N. Y.

National Association of Purchasing Agents—Public Utility Buyers' Group, mid-winter meeting, Wm. Penn Hotel, Pittsburgh, Pa., February 1-2. J. K. Hall, chairman, Columbus & Southern Ohio Electric Co., Columbus 15, Ohio.

Pennsylvania Electric Association—Electrical equipment committee, Hotel Roosevelt, Pittsburgh, Pa., February 8-9. B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

Edison Electric Institute — Accident prevention committee, Cleveland Hotel, Cleveland, Ohio, February 8-9; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 13-14; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 15-16. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Committee week, Wm. Penn Hotel, Pittsburgh, Pa., February 26-March 2 (spring meeting, February 28). R. J. Painter, assistant to the secretary, 260 S. Broad St., Philadelphia 2, Pa.

Output Curve Upward Trend Continued

The electric output curve during the week ended December 16, 1944, continued to move upward for the third consecutive week, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry amounted to 4,563,079,000 kw.-hr., as compared with 4,538,012,000 kw.-hr. the preceding week ended December 9. Figures for the week represented a decrease of 1.1 percent under the 4,612,994,000 kw.-hr. distributed during the corresponding week a year ago.

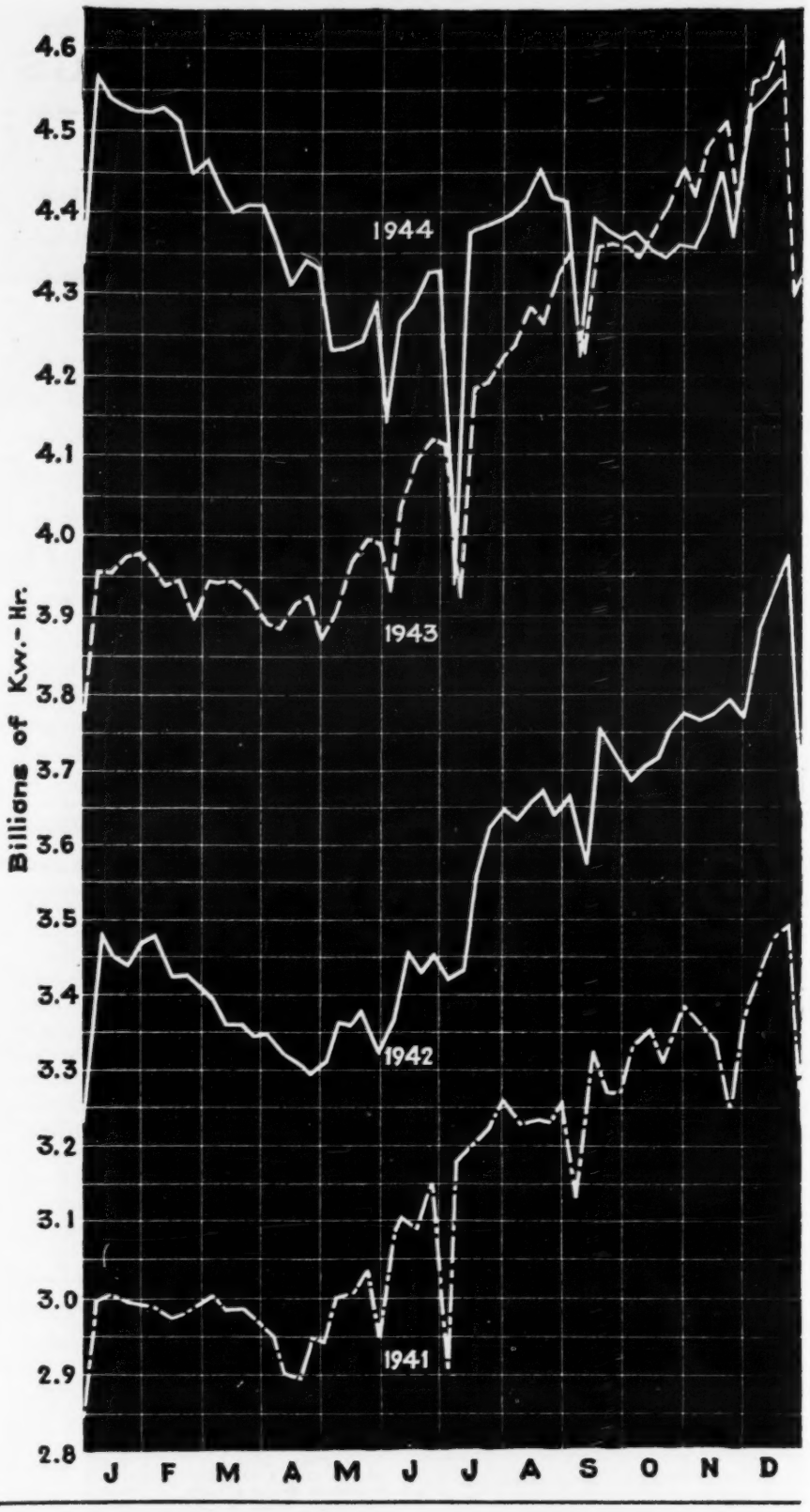
Three of the seven major geographic regions reported losses, as compared with the corresponding week of 1943—the Mid-Atlantic, Rocky Mountain and Pacific Coast states. The Rocky Mountain group for the week ended December 16 reported a loss of 10.4 percent under the loss reported for the corresponding week of 1943, as compared with a loss of 8.0 percent reported for the week ended December 9. The Pacific Coast group also showed an increased loss—4.6 percent compared with 2.9 percent for the week ended Dec. 9.

Weekly Output Millions Kw.-Hr.

1944		1943		1942	
Dec. 16	4,563	Dec. 18	4,613	Dec. 19	3,976
Dec. 9	4,538	Dec. 11	4,567	Dec. 12	3,938
Dec. 2	4,524	Dec. 4	4,560	Dec. 5	3,884
Nov. 25	4,369	Nov. 27	4,403	Nov. 28	3,766
Nov. 18	4,450	Nov. 20	4,513	Nov. 21	3,795
Nov. 11	4,397	Nov. 13	4,483	Nov. 14	3,776
Nov. 4	4,355	Nov. 6	4,414	Nov. 7	3,762
Oct. 28	4,358	Oct. 30	4,453	Oct. 31	3,775
Oct. 21	4,345	Oct. 23	4,415	Oct. 24	3,753
Oct. 14	4,355	Oct. 16	4,382	Oct. 17	3,717
Oct. 7	4,375	Oct. 9	4,342	Oct. 10	3,702
Sept. 30	4,366	Oct. 2	4,359	Oct. 3	3,683

Percent Change from Previous Year

	Week Ending		
	Dec. 16	Dec. 9	Dec. 2
New England	+ 1.3	+ 0.8	+ 1.8
Mid Atlantic	— 4.0	— 4.6	— 3.7
Central Industrial	+ 1.6	+ 2.3	+ 2.5
West Central	+ 9.4	+ 7.5	+ 5.1
Southern States	+ 2.0	+ 2.4	+ 2.3
Rocky Mountain	—10.4	— 8.0	—10.9
Pacific Coast	— 4.6	— 2.9	— 4.0
Total United States	— 1.1	— 0.6	— 0.8



Northern Indiana Utility Buys LaPorte Electric Co.

Purchase of the physical property of the La Porte (Ind.) Gas & Electric Co., by Northern Indiana Public Service Co., Hammond, for $2,500,000 was completed on Friday, November 24. Dean H. Mitchell, president of the Northern Indiana Public Service Co. announced recently. The La Porte utility, a subsidiary of United Light & Power, served approximately 7,600 meters in La Porte and Westville, Indiana.

Northern Indiana serves the territory surrounding La Porte, Mr. Mitchell pointed out and by interconnection. La Porte consumers will be assured dependable service.

Integration of the La Porte utility with Northern Indiana and the change of name will be the only changes, according to Mr. Mitchell. Personnel of the La Porte Gas & Electric Co. will continue in their respective duties as employees of Northern Indiana Public Service Co.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders recently issued affecting electric utility companies:

APPROVED PAYMENT of $350,000 by Texas Public Utilities Corp. to its parent, American Power & Light Co. The payment out of treasury funds represents the $50,000 balance on a 6 percent note due 1940 and a $300,000 partial payment on the $2,500,000 unpaid balance of a 7 percent income note due 1940.

HAS PERMITTED Federal Light & Traction Co. to withdraw its application proposing the sale of its interest in Springfield Gas & Electric Co. to R. H. Teed of Hot Springs, Ark. The contract covering the sale under its terms has expired.

HAS APPROVED Utah Power & Light Co.'s plan to absorb its wholly owned subsidiary, Utah Light & Traction Co. The traction company is to be dissolved after Utah's assumption of its assets and liabilities. Both companies are subsidiaries of Electric Power & Light Corp.

APPROVED LIQUIDATION of the El Paso Electric Co. of Delaware, a sub-holding company of Engineers Public Service Co. Engineers will pay El Paso $1,000,000 as a capital contribution to be used with other cash to retire at $1 a share plus dividends all of El Paso's Series A 7 percent and Series B 6 percent preferred stocks. Engineers also will assume El Paso's liabilities and receive as a dividend in liquidation the 150,000 outstanding shares of the El Paso Electric Co., a Texas corporation and an operating company of Engineers, together with cash and miscellaneous assets. Engineers will record its investment in the El Paso utilities at $6,597,114.

HAS APPROVED Washington (D. C.) Railway & Electric Co.'s proposal to borrow $3,500,000 from eighteen banks on two-year notes at 1¼ percent. Proceeds, with Treasury cash and $3,720,500—the amount of Washington's consolidated mortgage 4 percent fifty-year bonds assumed by the Capital Transit Co., Washington's parent—will be applied to the redemption at 105 of $6,858,900 of the 4 percent bonds. Washington will cancel $162,245 of first mortgage 5 percent fifty-year bonds of the Washington & Rockville Railway Co. of Montgomery County, Md., and deliver to Capital Transit $200,000 of Washington & Glen Echo Railroad Co.'s first mortgage bonds and $50,000 of its second mortgage bonds.

APPROVED PAYMENT by Middle West Corp. on December 20 of a $2 a share capital distribution on 3,307,201 shares of outstanding common stock to stockholders of record November 24, on condition that no dividends on the common stock be paid which will reduce the earned surplus accounts below $5,800,000.

Applications Filed

AMERICAN UTILITIES SERVICE CORP. has filed a plan of liquidation to replace its former plan of recapitalization. Under the liquidation plan, to be considered by the SEC on January 4, 1945, American would sell the stocks or notes of subsidiaries or cause the subsidiaries to sell their properties and liquidate. American has already agreed to the sale of Minnesota Utilties Co.'s electric and steam heating properties to the Northern States Power Co. of Minnesota. American would invite bids for the securities or properties of the remaining subsidiaries: Wisconsin Southern Gas Co., Bluefield Telephone Co.; Illinois Northwestern Telephone Co., Southeastern Telephone Co., Independence Waterworks Co. and the Suburban Water Co. of Allegheny County, Pa. Proceeds from the sale would be used to retire American's collateral trust bonds, satisfy its obligations, and make a pro rata distribution among holders of the preferred and common stock on an 85-15 percent basis. The liquidation program follows an order requiring American to recapitalize on a single stock basis after disposing of Minnesota Utilities and Wisconsin Southern Gas, and distribute its new common stock on an 85-15 basis.

ENGINEERS PUBLIC SERVICE CO. has asked for an additional four months in which to complete the expenditure of $4,000,000 to reacquire its $5, $5.50 and $6 cumulative dividend preferred stocks. The proposed extension would extend the purchase period to April 14, 1945.

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United Utilities Property May Not Be Sold to Co-op

The application of the United Utilities Corp. to sell electric properties in Missouri to the Northwest Missouri Electric Co-operative was dismissed recently by the Public Service Commission which said "it would be impossible at this time for the purchaser to serve all consumers of the seller" and therefore application dismissed. The cooperative owns properties in Andrew, Buchanan, Clinton, DeKalb, Gentry, Holt and Nodaway counties and planned to purchase properties of the United in Andrew, DeKalb and Holt counties.

UTILITY REPORTS

	Net Income 1944	1943
*American Gas & Electric and subs	$12,070,613	$12,001,272
*Carolina Power & Light	2,386,594	2,562,622
*Central Arizona Lt. & Pwr.	694,772	934,786
*El Paso Electric and sub	515,716	430,449
*Florida Power & Light	3,122,914	2,263,055
*Gulf States Utilities	2,707,501	2,053,757
*Kansas Gas & Electric	1,229,042	1,385,580
*Louisiana Power & Light	816,352	1,142,709
*Minnesota Power & Light	1,702,488	2,016,492
*Mississippi Power & Light	1,365,150	758,135
*Montana Power and subs	4,114,429	4,384,423
*Nebraska Power	1,694,858	1,656,616
*New Orleans Public Service	1,703,639	1,906,541
*Pennsylvania Power & Light	5,554,846	5,890,339
*Puget Sound Power & Light and subs	4,522,090	4,581,657
*Savannah Electric & Power	248,877	262,730
*Virginia Electric & Power and sub	5,352,438	4,502,910
*Washington Water Power and sub	2,623,621	3,193,010

* Twelve months ended October 31.

Reclamation Association Against Additional "TVA's"

The National Reclamation Association adopted a resolution opposing creation of more river valley authorities at its recent convention at Denver.

The Association declared that the U. S. Army Engineers and the Bureau of Reclamation, of the Interior Department, "are long experienced in making surveys and plans in their respective fields and supervising their execution and are fully competent to continue..." Regional authorities, the Association charged, "build unwholesome and undesirable government monopolies."

The Association also approved a resolution urging that functions of the Bureau of Reclamation which are now under the jurisdiction of Interior's Power Division be restored to the Bureau.

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"Interior Dept. Natural Habitat for MVA," Ickes

Interior Secretary Harold L. Ickes told a press conference recently that he favored a Missouri Valley Authority, and added that "the Interior Department would be the natural habitat for an MVA."

Ickes said he would make the same statement if he were leaving the Interior Department forever, adding:

"The Interior Department has been administering public lands since the foundation of the government."

Arguing that the President is carrying "the heaviest administrative burden of any man in the world," Ickes said establishment of an independent MVA would only subject him to more routine and detail work.

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Arkansas Governor Plans Merger of Commissions

Governor Elect Ben Laney will ask the 1945 legislature which meets next month to consolidate the Arkansas Department of Public Utilities with the Arkansas Corporation Commission. Announcement of the new governor's intentions was made before a joint Budget Committee of the legislature by W. J. Smith, recently appointed Mr. Laney's legislative secretary.

The Budget Committee informed Mr. Smith it would like to hear Mr. Laney personally explain his reasons for the contemplated merger. Department of Public Utilities is now set up under the three-man Arkansas Utilities Commission. The merger is proposed by Mr. Laney as part of his economy program.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

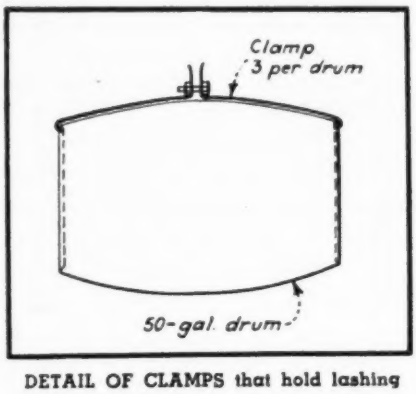
Float Cable on Steel Drums

By W. K. SELF
Supt. Construction and Maintenance
Indiana Service Corp., Fort Wayne, Ind.

Many ways are employed for laying power cables across rivers and streams. One that has been used successfully by Indiana Service Corp. to extend two 35-kv., three-conductor, 300 MCM., gas-filled underground cable circuits across two narrow streams in the Fort Wayne area has some unusual features. In brief the cable, its lead sheath covered with jute and steel armor wire and weighing about 20 lb. per ft. in river sections, was floated across the stream lashed to 50-gal. steel drums. Floating cable and drums were next pulled into an arc bowed upstream and the cable lowered to the stream bed by freeing the drums one at a time.

Reason for bowing the cable up stream was so that it might lay on the bottom of the stream and not be subject to strain due to flow of the stream. This would allow plenty of slack for cable to settle into mud, follow irregularities of stream bottom, and not cause strain on the cable.

SUBMARINE POWER CABLE floated from 50-gal. steel drums spaced at 15 ft. intervals is pulled across stream. Men are shown lashing the drums to the cable as it is paid out



DETAIL OF CLAMPS that hold lashing rope in place around center of drums

Manholes were constructed on both banks of the stream. Ends of the cable were anchored in the manholes. At the first crossing the manholes were 277 ft. apart; the stream 160 ft. wide and maximum water depth 16 ft. At the second stream manholes were 160 ft. apart; the stream 130 ft. wide and maximum water depth 10 ft. In both instances there was one to two feet of mud on the bottom.

Before the cable could be lashed to the drums, means had to be found

ANCHORED at both ends, cable is pulled up stream in a bow by blocks strung between cable and ½-in. messenger across river upstream

to keep the lashing from slipping off the tapered ends of the drums. This was done by spacing three two-part clamps around each drum, as shown, to form ears that would hold the rope. Each half-clamp, made from a crossarm brace, had a short bend or hook at one end (to engage the bead of the drum) and a projecting right angle bend at the other. By bolting two such half-clamps together at the middle of each drum, ears were formed that kept the rope from slipping.

With the drums fitted with clamps, the cable reel was set up at the stream bank and fastened to a winch line run across the stream. As the cable was paid out drums were attached by wrapping a rope once around the cable, twice around the drum between ears of the three clamps, and tying a slip knot *on top* of the drum. Drums were spaced every 15 ft.

To bow the cable upstream a ½-in. steel messenger was stretched across the river up stream from the cable, and the cable bow formed from it. Rope loops were placed around the cable at several points and attached to

blocks fastened to the upstream messenger, that pulled the cable into position. Then, beginning at one end of the floating bowed cable, the slip knots were loosened, drums removed and the cable lowered into position in the stream bed.

This method was found to be simple. It required no special tools or equipment except homemade clamps. Moreover, the cable was under control at all times and could be placed as desired. Very little time was required to complete the installation once the cable was started across the stream.

Check Meter Connections without Tracing Wires

By W. C. NODDINGS

Master Mechanic and Electrical Engineer, Raritan Copper Works, International Smelting and Refining Co., Perth Amboy, N. J.

A solution for checking polyphase wattmeter or watthour meter connections without tracing wires or checking up on polarity marks of the meter or instrument transformer, resulted from trying various connections with a wattmeter that had been connected wrong and continued to read zero regardless of the connected load.

The solution was arrived at by exchanging the line potential leads at the meter (leaving the common bus or grounded leads intact) and if any wattmeter reads zero or any watthour meter stops turning when such action

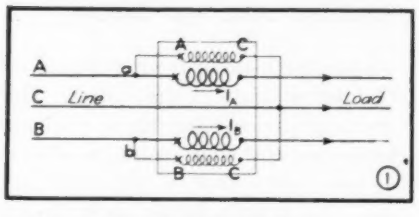


FIG. 1—Correct meter hookup

is taken, then the meter in question was properly connected in the first place and the leads should be put back as they were. In other words, if A potential and A current together with B potential and B current are properly paired up to give correct readings, then the zero reading will result if B potential and A current together with A potential and B current are paired up instead. This to the author substantiated the article "Checking Watt-Hour Meter and Wattmeter Connection" by Raymond S. Brown and P.

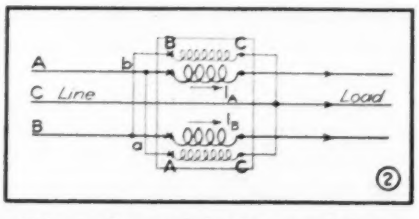


FIG. 2—Potential leads a and b reversed, reading zero

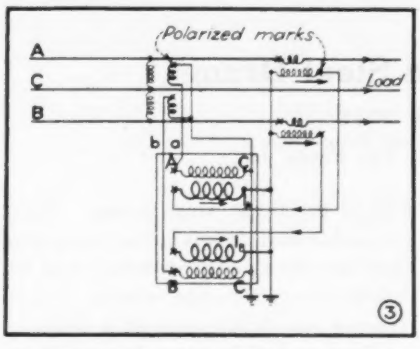


FIG. 3—Meter with additive instrument transformer correctly connected

Ackerman in ELECTRICAL WORLD, January 17, 1914, page 144.

It is to be noted in Figs. 3 and 4 that the common potential leads C at the meter are connected together and grounded. They must be at least connected together *or this test will fail* when using potential transformers. There must be a common re-

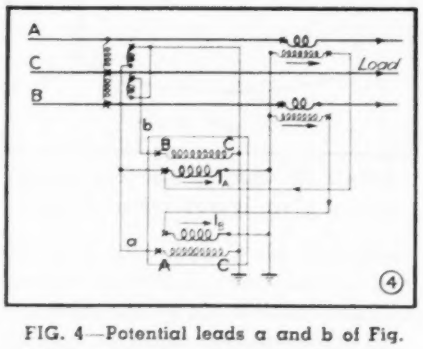


FIG. 4—Potential leads a and b of Fig. 3 have been interchanged. This interchange causes the meter to read zero

turn lead to the potential transformer secondaries on the C phase as shown. It is important to note that if each potential transformer secondary supplies a meter potential coil and there is no interconnection between the two circuits, then switching the two leads a and b has no real meaning.

In the vector diagram of Fig. 5 the two pairs of currents and potentials shown bracketed are the proper ones to use on the two meter elements as shown in Figs. 1 and 3. The solid current vectors and brackets are the

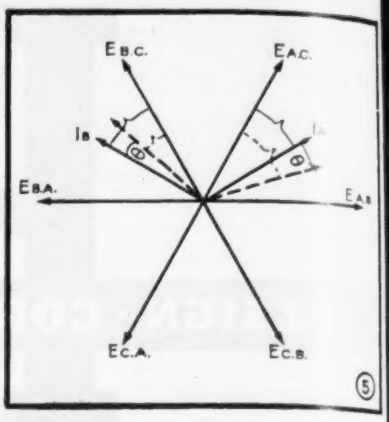


FIG. 5—The two pairs of currents and potentials shown bracketed are the proper ones to use on the two meter elements as shown in Figs. 1 and 3. The solid current vectors and brackets are the relative position at unity p.f. and the dotted current vectors and brackets indicate the position with a lagging p.f. angle. The product of current times voltage times the cosine of the bracketed angle equals the power recorded by each element of the meter

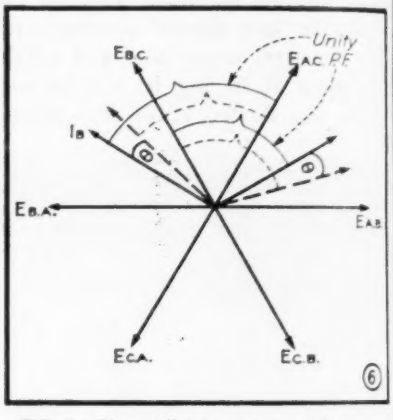


FIG. 6—Shows the same vector diagram as applied to the connections in Figs. 2 and 4. Here (I_B and E_{AC}) and (I_A and E_{BC}) are bracketed together. The solid brackets indicate the position for unity p.f. and inasmuch as the voltage and current vectors are at right angles, no power whatever will be registered by either element. The dotted brackets indicate the relative position for a lagging p.f. and in this case (I_B and E_{AC}) will record a positive reading of $I \times E \times \cos.(90-0)$. Likewise the other element (I_A and E_{BC}) will record a negative reading of $I \times E \times \cos.(90+0)$ but of equal value to the power reading of the first meter element. The algebraic sum of the two power readings by the two elements will therefore still be zero no matter what the power factor of the load may be

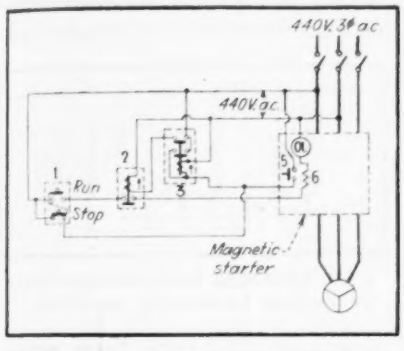
relative position at unity p.f. and the dotted current vectors and brackets indicate the position with a lagging power factor angle θ. The product of current times voltage times the cosine of the bracketed angle equals the power recorded by each element of the meter as is well known.

•

Time Delay Stops Tool Insert Breakage

By C. M. BOARDMAN
Industrial Utilization Engineer
Duquesne Light Co., Pittsburgh, Pa.

Whenever there are voltage dips falling below the 60 percent (for which starter interlocks are customarily designed to hold in) there is risk of breaking the sintered carbide cutting inserts in the automatic lathe cutting tools when the motor is automatically braked to an abrupt stop. Wherever lathe attendants have to await a supervisor, whose duty it is to replace the tools, reset the lathe and restart the operation, the consequent delay can be avoided by means of the scheme shown in the accompanying diagram. It is designed to hold the starter run circuit closed for 1½ sec. and thus ride through a reclosing period of about 30 cycles. Tests showed that these lathes were still rotating for about 60 cycles.



TIME DELAY of 1½ sec. keeps closed circuit to closing coil (6) on starter to ride lathe through momentary dip in voltage, avert tripping out and breaking the tools cutting-tool inserts

Legend: (1) Two unit, maintained-contact, heavy duty pushbutton with mechanical interlock, "run-stop" type stop button acts as reset; (2) time-delay, low-voltage, pushbutton station, ½ to 4 sec., 440-volt 60-cycle (relay only used); (3) a.c. contactor, two-pole, normally open, 440-volt, 60-cycle, 10 amp.; (4) present electrical interlock on starter (closed when starter is closed); (6) present closing coil on starter

The scheme also makes for safety of the machine operator by comparison with the risk that would be incurred if an ordinary maintain-contact device were used; the latter would be undesirable because the starter might re-start the motor after it had come to rest during a more prolonged interruption of the service to the motor. Items 2 and 3 are inserted between the item 1 and the starter. Item 2 is an escapement type of device which gives a definite time-delay independent of the extent or duration of the voltage dip. Item 1 is a maintain-contact pushbutton which replaces the customarily-provided momentary-contact button. All items are standard industrial control items.

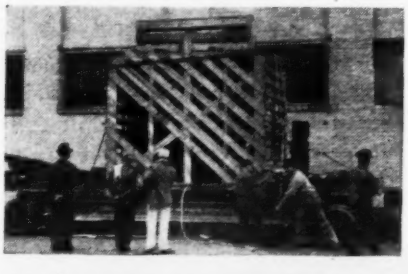
Transformer Transported by Trailer in Chile

Overland transportation of a 1,600 kva., 44/15-kv., 3-phase transformer presented many problems and called for considerable ingenuity on the part of the Chief Engineer of Cia. General de Electricidad Industrial in Chile.

The 14-ton unit manufactured by the Standard Transformer Co., Warren, Ohio, was unloaded from a vessel to a dock at Valparaiso. From this point it was to be shipped to a substation in the rural township of Buin, approximately 20 miles south of Santiago and some 120 miles from Valparaiso.

Shipment of the transformer via railroad was out of the question because the unit was too tall; the tunnels had insufficient clearance. On the other hand, a good road connects Valparaiso and Santiago but the concreted sections are narrow with sharp curves, also the road lies over three separate ranges of hills or mountains which are over 3,000 ft. high.

Final decision involved the loading of the transformer on a trailer powered by three Chevrolet 3-ton trucks. Each truck was connected directly to the trailer by a steel cable. On the level and up the hill the trailer was pulled by the three trucks but on the downhill stretches one truck towed and the other two trucks braked.



TRANSFORMER WEIGHING 14 TONS is loaded on trailer at dock. (upper left) Oil is transferred to drums to decrease gross weight and to lend stability to towing trucks on which the filled drums were loaded. (upper right) Convoy of three 3-ton trucks tows the trailer on level and upgrades. (lower left) Convoy takes a downhill curve. Front flagman walks ahead. One truck tows, other two trucks serve as brake. (lower right) Transformer lifted off trailer at Buin

The innumerable upgrades and downgrades required constant changing of the truck positions. But the truck crews became quite expert after a few changes and lost only about 10 min. in reversing their positions.

The trip required three full days from the loading of the transformer to the trailer at the Valparaiso dock up to the unloading at Buin. Some high points on the trip are shown in the accompanying illustrations.

Stability Demonstration Makes Better Operators

The necessity of serving wartime loads with existing facilities has made it necessary to operate many transmission lines in the upper ranges of stability limits in order to handle the heavy loads. To give operators a better idea of what is meant by stability and help them to operate more intelligently, Pacific Gas & Electric Co. set up the demonstrations board illustrated and conducted meetings at important plants and substations throughout its system.

System Simulated

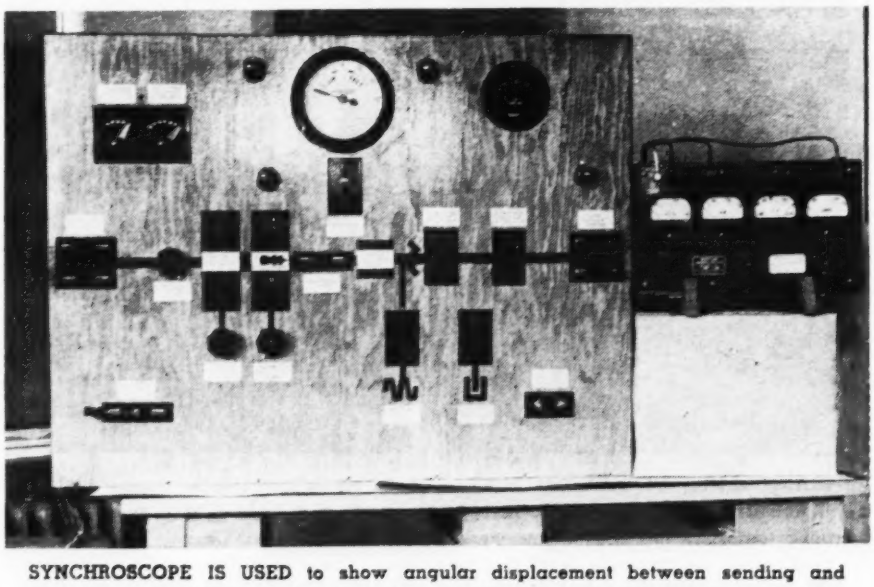
The board is really a small calculating board on which may be simulated the company's 230-kv. and other high-voltage lines. An old 1-kw. plate-supply motor-generator set served as the source of variable frequency. It is driven from the d.c. end by a mercury arc rectifier tube found among old parts. An industrial analyzer used by pump testing crews was cut over from three-phase to single-phase, a synchroscope and frequency meter were borrowed from one of the stations and with other spare parts the set was built up as shown.

The demonstrations were made by F. R. George, engineer of operation, and I. W. Collins, assistant engineer of operation, who jointly developed the idea. In all, 23 classes were conducted with very tangible benefits to the operating force. The synchroscope was used both to demonstrate speed and ease in bringing in a machine or line and to show angular displacement between the two ends of a transmission line with loadings in actual kilowatt readings. Tests showed pull-out from instability, what happens to phase displacement during switching and faults and any number of other operating conditions and problems. Operators were permitted to spend as much time as they wished in setting up conditions and manipulating the board themselves.

Operators Benefited

Few operators pay much attention to the technical aspects of stability but they were interested and did understand the demonstration and the mechanical analogies used, with the result that they really got an insight into what goes on in power systems. They are much better operators as a result of this schooling.

The test board has been dismantled because certain instruments could no longer be spared, but the demonstration aroused so much interest, even among officials and company engineers, that a new and permanent demonstration board will be made up as soon as equipment is obtainable.

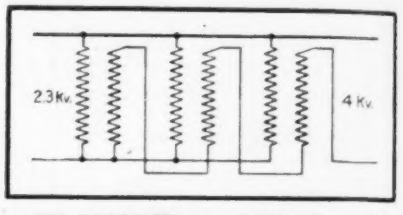


SYNCHROSCOPE IS USED to show angular displacement between sending and receiving ends of transmission line under various loadings in demonstration to show operators the mechanics and importance of stability

•

Triple Boost Gives Dry-out Voltage

Following a repair job, a 66-kv. transformer on the East Tennessee Light & Power Co. system had to be dried out. The transformer reactance was 6 percent and thus 4 kv. was required to circulate full load current through the windings. But 4 kv. was not available at that particular



4 KV. OBTAINED from 2,300-volt supply by unusual transformer connection

place, only 2,300 volts. There were at hand, however, several 2,300/460-volt distribution transformers and in these was found the solution of the problem. Three of them were connected together in the manner of the accompanying diagram to make a multiple booster with the voltage equation

$$2300 + 460 + 460 + 460 = 3780$$

Actually the local voltage could be raised to above 2,400 which brought the dry-out potential pretty close to the required 4 kv.

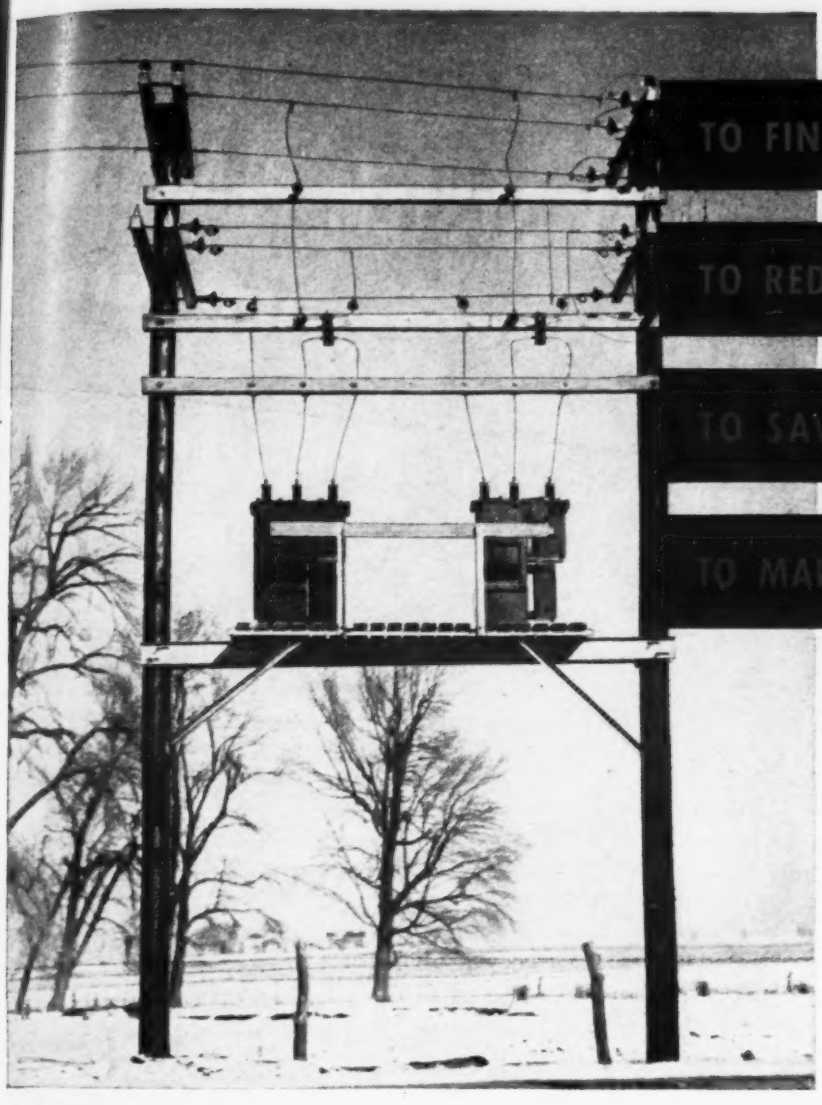
•

Method of Cutting-over 2,300 Δ to 4,000 Y—II

2. Installing Temporary Tie

By J. J. BURRI
Superintendent of Distribution
Staten Island Edison Corp., Staten Island, N. Y.

The second step in the changeover from 2,300-volt delta to 4,000-volt wye (first step described in ELECTRICAL WORLD, December 9, page 121) was to install a temporary tie between one phase of the 2,300-volt delta circuit and the neutral. Before



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OBVIOUSLY, you will find it a lot easier to handle the distribution problems that arise from war loads, one or two shifts instead of three, and reconversion, if you can get the voltage up and hold it there.

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Remember, too, aside from the improved service they make possible, that "there's revenue in regulators." They are still near the top of the list of good self-liquidating investments. Actual case histories indicate annual savings of from $834 to $9950 *on a single feeder*.

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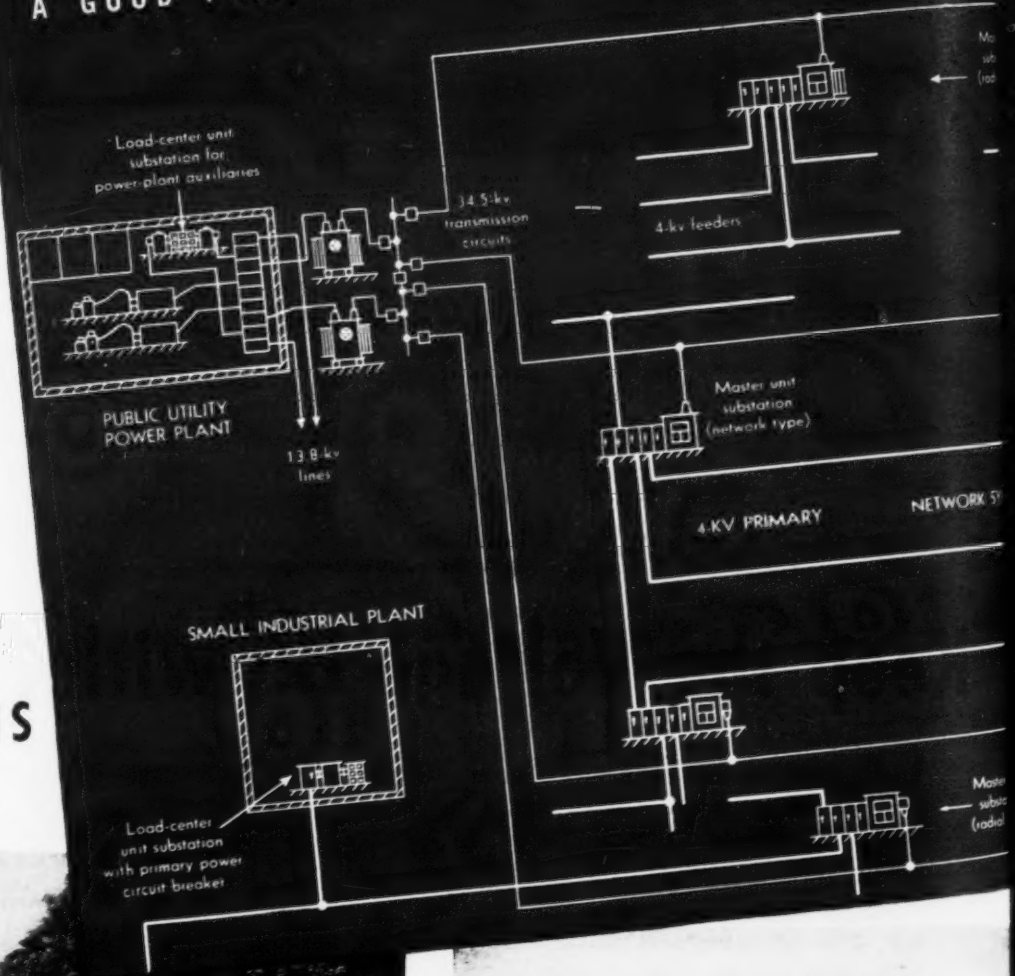
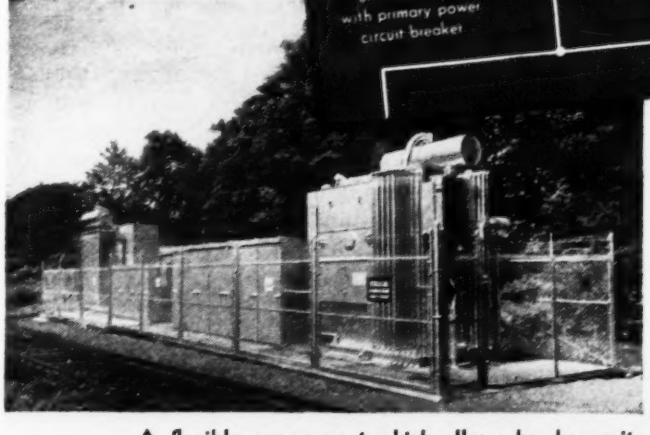


UNIT SUBSTATIONS



A flexible arrangement which allows breaker units to be added as the load grows—without disturbing existing equipment. If the load shifts, these substations can be moved easily to the new load centers.

Two master unit substations installed in one location to provide duplicate transformers and subtransmission feeds for the feeder bus.

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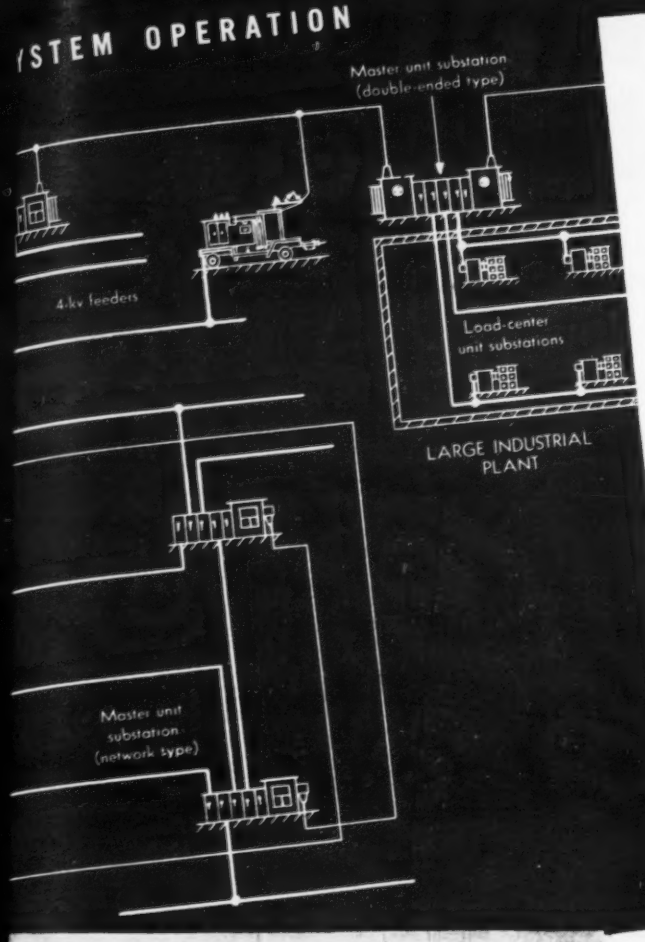

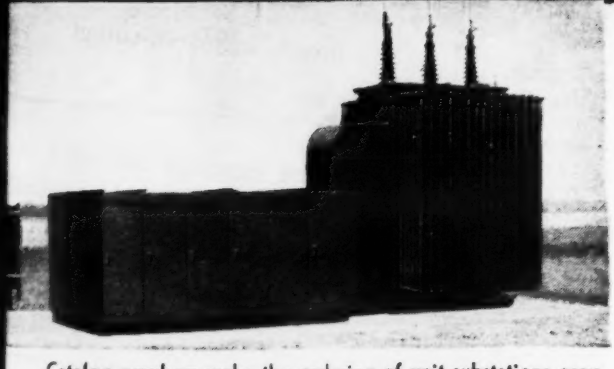

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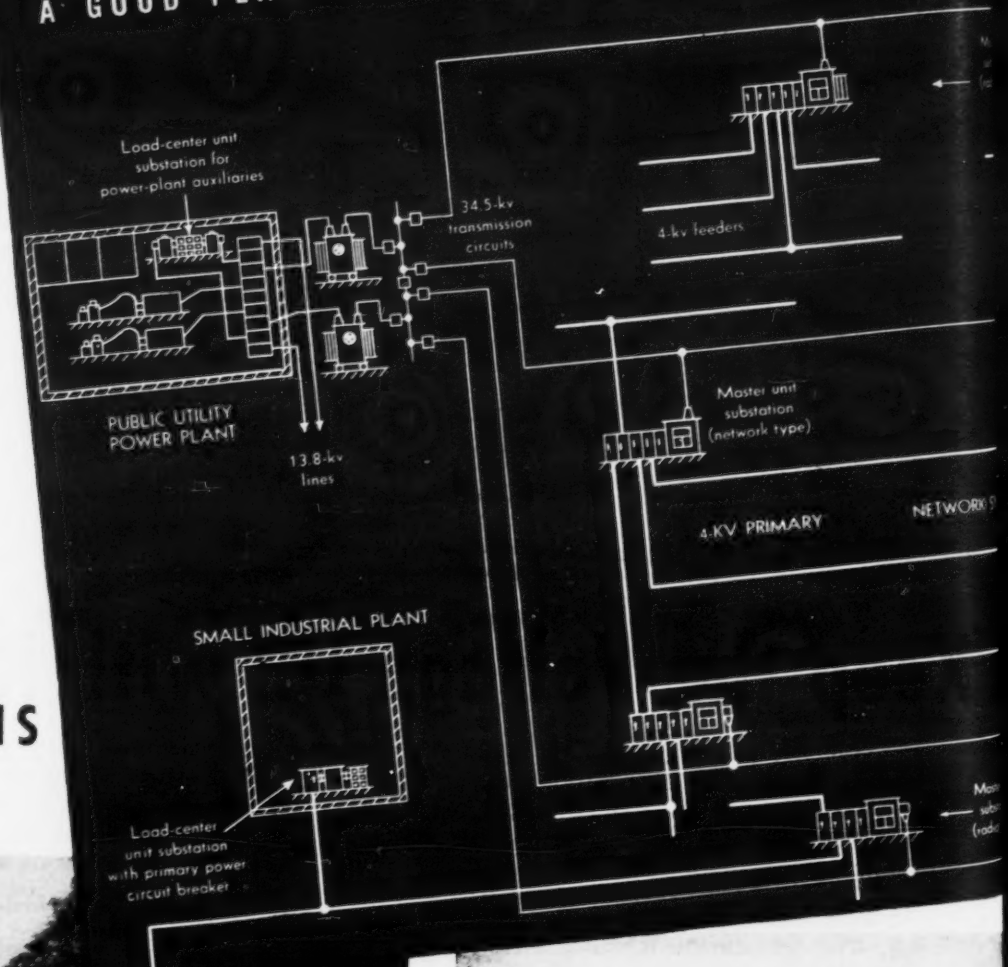

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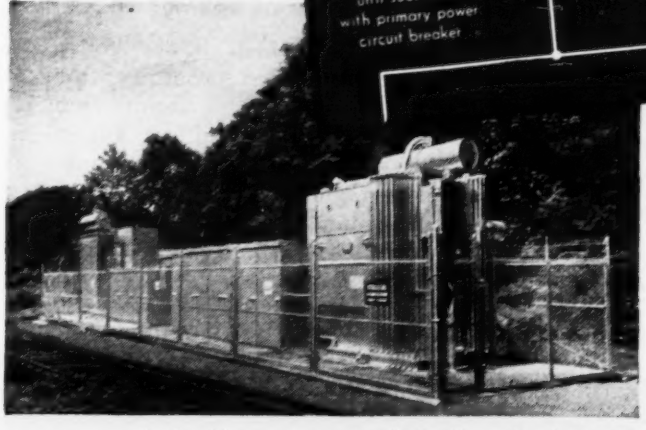

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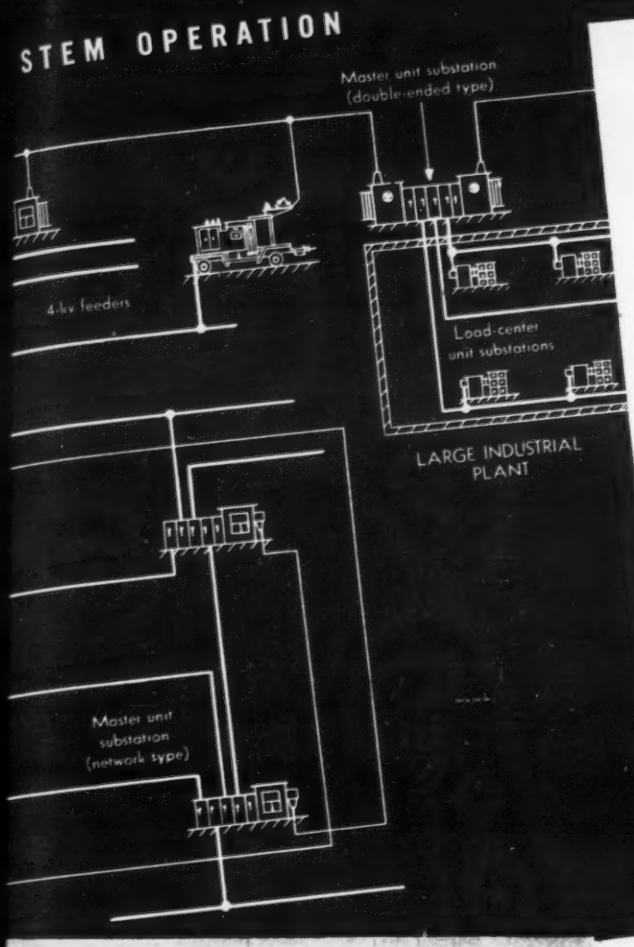

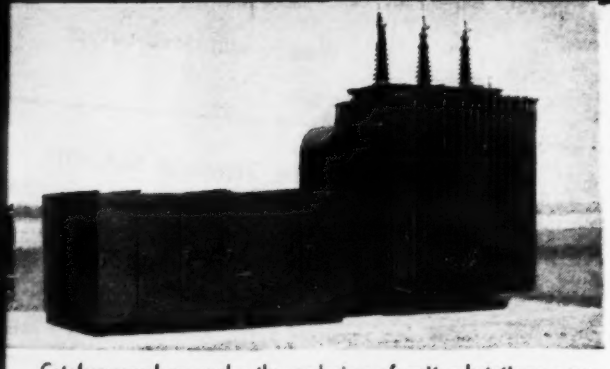

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*G-E unit substations are now being built repetitively from standard components for almost any application you may have.

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302-21-5900

You Get WIDE SPEED

Data from a few actual installations

SPEED RATIO	RPM	APPLICATION	RESULTS
100 : 1	50 to 5000	Drive for magneto testing	Faster and more accurate testing
100 : 1	30 to 3000	Drive for material-testing machine	Constantly increasing rate of tension maintained until material breaks
25 : 1	100 to 2500	Lathe-headstock drive	Increased cutting range and fewer gear changes
20 : 1	85 to 1700	Spar-mill drive	Greatly increased output
3 : 1	1000 to 3000	Drive for machine used to test airplane-propeller governors	More complete test data, as well as speed and precision of testing

NOTE: Likewise, the speed range of Thy-mo-trol drive can be built to suit the requirements of your application. May we discuss your requirements?

GE

THY-MO-TROL DRIVE

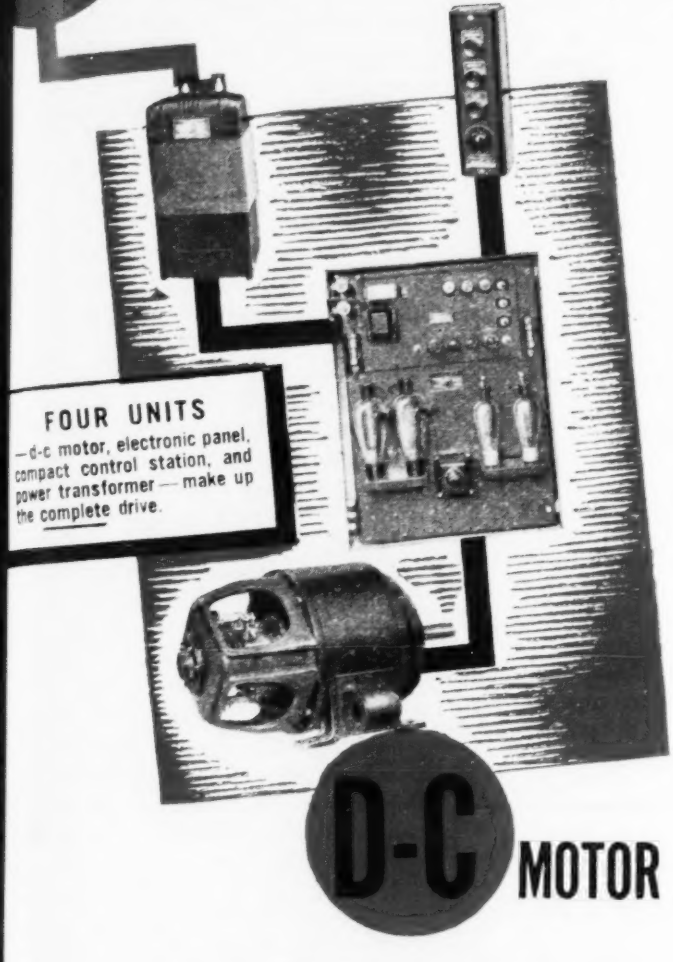
Where Else Can It Be Applied?

Drill presses, to increase speed range and the number of kinds of work handled. Grinders, for precise speed selection and improved finishing. Milling machines, to increase variety of work handled and to simplify design. Cable reelers, to maintain constant tension. Conveyors, to match speeds. Also, automatic arc-welder carriages, weld positioners, pumps, boring mills, automatic screw machines, thread-milling machines, tube-forming machines, alternator speed control, paper and cellophane reels, shell-lathes, and numerous other applications.

RANGE *and more*

with THY-MO-TROL DRIVE

A-C POWER


FOUR UNITS
—d-c motor, electronic panel, compact control station, and power transformer—make up the complete drive.
D-C MOTOR

IT gives you speed ratios even greater than 100:1: This new electronic equipment makes available the full, wide speed range of d-c motors—*on a-c* power!

Just a single dial provides this smooth, automatic, full-range control. A single dial—small as a radio volume control, and mounted in the push-button control station—gives complete adjustment of motor speed, from zero to maximum. Thus, you can easily and quickly obtain the exact speed you want, whether, it be for roughing or fine finishing.

Here Are Six OTHER Advantages:

1. Stepless speed control
2. Constant speed under changing load
3. Smooth, fast, constant-current acceleration
4. Low maintenance
5. Speed can be preset before starting
6. No stop for speed change

A Complete Drive

Thy-mo-trol drive takes a-c power from your supply line and, through its d-c motor, delivers torque to your load over a wide range of speeds. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single, compact control station.

How to Buy Thy-Mo-Trol Drive

Standard Thy-Mo-Trol drives can be obtained in ratings from fractional-horsepower sizes up to 10 hp; higher ratings can also be provided.

This electronic motor control makes possible improved machine design, performance, and operating technique. In order to be sure that you get the full advantage of this new drive, G-E engineers want to consider each application as an individual case. We suggest you get in touch with our local office, giving complete information about your machine for which the drive is required. General Electric, Schenectady, New York.

BUY WAR BONDS

ANOTHER G-E "FIRST" IN INDUSTRIAL ELECTRONICS

GENERAL ELECTRIC

676-104-8930

doing this it was necessary that all phase wires be cleared of grounds as this is a requisite of the wye system. Care also had to be exercised, if there were regulators on the circuit, that jumpers were not placed on both the line and load side of the regulators.

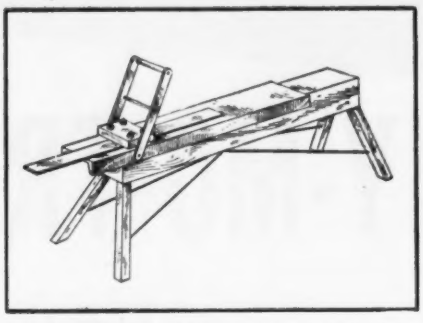
With the neutral tied to one of the former phase wires all single phase loads are reconnected to the neutral and one of the other two phase wires. The three-phase power banks are allowed to operate as usual for the time being. At the same time the single-phase loads are being reconnected, cutout boxes are removed from the neutral leg of all transformers and the primary phase wire converted to neutral.

It should be noted, that by such procedure, the substation bank has single-phase load directly across only two of the three transformers. This produces an unbalanced load on the substation bank and the transformers will not share the load equally. If the load is nearly balanced between the two phases, the transformer across which no load is directly connected will carry approximately two-thirds as much load as the other two transformers. This unbalance should not cause concern unless the bank is already overloaded.

Copper Bent Easily and Quickly on Horse

By THOMAS DUNN
Plant Engineer, Freeport Municipal Plant Freeport, L. I., N. Y.

Bending copper has been made easy and quick by use of a home-made horse. The copper strip to be bent is tightened between the channel iron and the steel block so that the mark where the bend is to be made is exactly at the end of the squared face of the channel iron. The bend is made by bringing the pressure-exerting swivelled hand bar down against the copper bar and pushing.



HOME-MADE HORSE with 4 by 4-in. plank top. 6-in. channel iron is inverted and fastened to the plank. Copper to be bent is held in place by a 4-in. square steel block, the pressure being obtained by tightening the bolts into threaded holes in the channel iron. Pressure for the bend is exerted on the copper by a ½-in. round bar; above it is the 1-in. round bar for applying hand pressure. The levers are 1 by ¼ by 18-in. cold roll steel

Maximum bend obtainable is 90 deg. and the maximum size copper that can be handled is 2½ in. by ¼-in. The copper can be marked, bent and tried for fit in approximately 5 min.

Turbo-Generator Tripped by Just a Cap Screw

By GEORGE I. SMITH
Switchboard Operator, Minnesota Power & Light Co., Duluth, Minnesota

A 25,000-kva. steam turbo-generator was tripped off the line while carrying 18,000 kw. of the morning peak load. There was no target on the relays to show the reason for tripping. The only clue was that a 600-hp. induced-draft fan was started, or rather tried to start, at that time on the 2,300-volt unit station service bus.

Since the fan had started regularly on the standby transformer bus without difficulty, arrangements were made to duplicate conditions except for minimum load on the generator and to try again to start the fan. The unit again tripped off the line, but this time a target showed that the unit transformer "A" phase differential relay had operated. This indicated a fault in the relay circuits.

The relay trip circuit was opened, load put on the transformer, and readings taken at the relay of the six current circuits. The high-side current transformers were balanced but "A" phase low-side was about one-quarter that of the other two phases. Current readings at the 2,300-volt O.C.B. cubicle were balanced, indicating a grounded conductor in the cable from the cubicle to the relay. However both ohmmeter and insulation tester showed good cable insulation. It was then noted that the back panel had been removed before reading the currents at the cubicle.

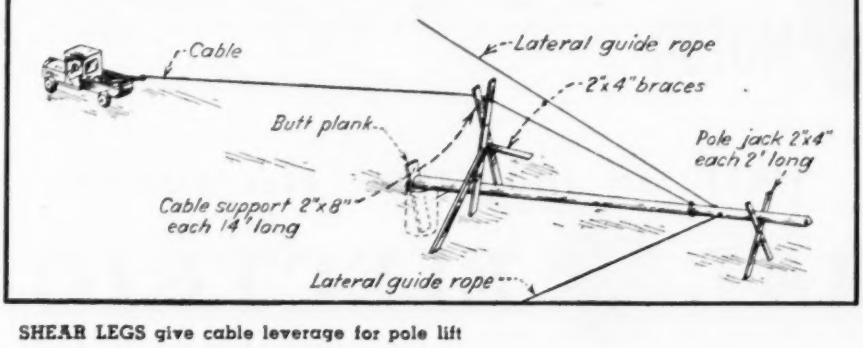
Examination of the internal wiring revealed that a long cap screw had entered a group of wires just back of the upright frame, cut the insulation, severed twenty strands and grounded one conductor.

All cap screws for the back cover panels were replaced by studs, welded to the cubicle frame, with nuts outside the panel.

Tall Poles Raised by Winch Cable

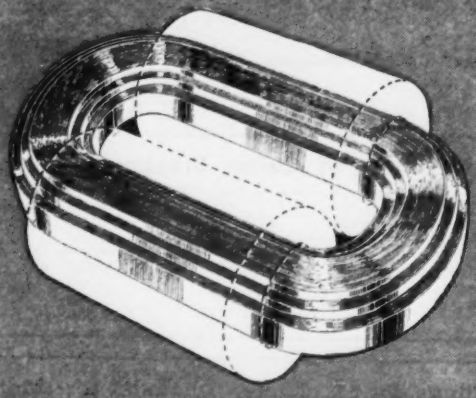
By M. L. MONSON
Municipal Light and Power, Fosston, Minnesota

Due to the inability of securing labor to raise some of the larger poles in building a line, we worked out a system of pole raising by using an auto-wrecker. The cable was run from the wrecker to and over a cable support made up of 2 by 8 in. sticks each 14 ft. long. This X-support was made so that the bottom would fit the pole just snug and was braced by means of two 2 by 4's, one on each side. The end of the cable was then fastened to the pole about two thirds of the way from the butt. A guy rope was fastened to each side of the pole in order to keep it from turning.



SHEAR LEGS give cable leverage for pole lift

distribution engineers vote for the Round-Wound idea



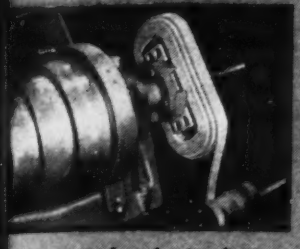
X L-M ROUND-WOUND Distribution Transformers

Distribution engineers who see Round-Wound transformers made become enthusiastic voters for the Round-Wound idea.

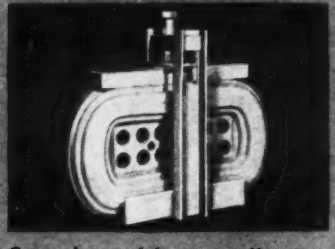
The Round-Wound principle provides a basically correct core—the right material, wound into an elliptical shape, under tension, without air gaps; without wasteful corner sections; undisturbed after annealing. Coils are round-wound into position right onto the completed core.

Advantages inherent in the wound core permit fewer turns in the coil. Long coils are evenly round-wound, without air spaces between layers, and have precisely the right ratio of length to thickness, reducing leakage flux and reactance. Coils envelop a maximum of the iron circuit, and expose a relatively large surface to cooling oil. These factors, and the generous undisturbed insulation, provide uniformly higher impulse strength, minimizing lightning hazards; give greater short-time overload capacity; and give better regulation at all power factors.

How core is wound



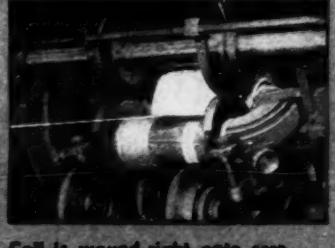
Core wound under tension: no air gaps; exciting current as much as 50% lower. Core is not stacked, not laminated; no wasteful corner sections. Silicon steel strip is wound 100% with the grain, in elliptical shape closely approaching the perfect magnetic flux movement—100% "downstream."



Core clamped for annealing; not disturbed, cut, or rewound after annealing; assures stable characteristics; freedom from stress; lower core loss. Cross section is cruciform, approximating the round; this shape permits winding a round coil, and provides passages for the cooling oil.

How we get the round coils onto the wound core

Geared split flanges are placed around the core legs, which have been lapped. Core leg acts as a shaft upon which flanges are revolved in the winding machine. First an insulating paper tube form is wound on; this becomes a permanent part of the finished coil. The flanges are removed later, after winding is completed.



Coil is wound right onto core. Uniform tension prevents air spaces between layers. Fewer turns can be used in coils without sacrificing low exciting current. This decreases copper loss and lowers resistance. Oil duct spacers wound into coils provide additional cooling which eliminates any hot spots.

L-M Round-Wound distribution transformers are available in 1½ to 25 Kva., 2400 to 7620 volt ratings, and meet all EEI and NEMA standards. For more details, get a copy of Bulletin RW-421 from your nearest L-M sales office, or write Line Material Company, 808 No. 8th St., Milwaukee, Wis.

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

SELECTION OF CIRCUIT BREAKERS FOR MOTOR PROTECTION

By GEORGE L. COLE, I-T-E Circuit Breaker Co., Philadelphia, Pa.

A motor starter with its overload protective relays does not, as a rule, provide short circuit protection. A dependable way of supplying this protection is by using a circuit breaker either ahead of the starter or in a combination starter.

Since the relays giving running overload protection are generally actuated by thermal units, the circuit breaker need not be equipped with thermal trips. It must trip instantaneously when a short circuit occurs and it also serves as a disconnect switch.

Circuit breakers for this service are available in ratings up to 600 amp. continuous duty, up to 600 volts a.c. or 250 volts d.c., 2- and 3-pole. Interrupting ratings are listed in Table 1. Breakers are enclosed in molded cases, installed in combination starters or in separate enclosures. Instantaneous magnetic trips are provided but no time-delay thermal trips. Opening time is one-half to three-quarters of a cycle on a sixty-cycle basis.

Breakers are calibrated at the factory within the ranges in Table 2. The entire case of the 100 amp. frame size is sealed to prevent tampering. Trip units of the 225 and 600 amp. frames are interchangeable; trip unit case is sealed. Interchangeable trip units allow installation of additional motors on the circuit. Trip points are not adjustable in the field.

Selection — Principal considerations are: (1) Voltage a.c. or d.c. (2) Circuit supplying single motor or a group. (3) Full load current; motors started individually or simultaneously. (4) Short circuit capacity of power supply; interrupting rating of breaker. (5) Auxiliary devices (shunt trip, alarm switch, etc.)

One A.C. Motor—The transient or inrush current is generally 140 to 180 percent of the locked or stalled rotor current. Select a breaker with an instantaneous trip point of 140 to 180 percent of the locked rotor current. The locked rotor current of a.c. motors is frequently about 750 percent of the full load current.

As a *general rule* for normal-torque motors the instantaneous trip point should be twelve to fourteen times the full load current rating, which should be checked against the continuous ampere rating of the breaker to make sure that the breaker will carry the full load current continuously.

It has become the practice of many motor manufacturers to stamp a code letter on the nameplate indicating the approximate locked rotor kva. See Table 3.

Several A.C. Motors—As a *general rule*, where the full load current of all the motors on a feeder circuit is not in excess of 100 amp., the instantaneous trip point should be eight to nine times the full load currents of the motors. Where full load current is from 100 to 600 amp., the trip point should be six to seven times.

Sometimes there are several small motors and one large motor on a circuit. If all the small motors are running when the large one is started it may be necessary to take the totals of the full load currents of the small motors and add to them twelve to fourteen times the full load current of the large motor.

One or Several D.C. Motors—Direct current motors are usually started with lower values of current inrush than a.c. motors. It is advisable, therefore, in selecting the instantaneous trip point of a circuit breaker which will be relied upon for short circuit protection, to take full advantage of the minimum trip point available, which is usually six to seven times the full load current of one motor or the total full load current of several motors.

General Comments—It has been assumed above that when there are several motors on a line, they will not be started simultaneously. If they are, they should be regarded as a single motor with a full load current equal to the total of the full load currents of separate motors.

It is assumed that frequency is sixty cycles. Other frequencies may require special consideration.

Circuit breakers have no short-time ratings higher than their continuous ratings. If motors are to be overloaded, a breaker should be chosen with a continuous rating equal to the maximum current.

Table I. Ratings of Circuit Breakers

Frame Size Amp.	Voltage	Interrupting Rating, Amp. a.c.	Interrupting Rating, Amp. d.c.
100	250 a.c. and 125/250 a.c., d.c.	15,000	5,000
100	600 a.c., 250 d.c.	15,000	10,000
225	All ratings	15,000	10,000
600	All ratings	25,000	20,000

Table 2. Factory Settings for Circuit Breakers

Instantaneous Trip Range, Min. and Max. Amp.	Nameplate Rating, Amp. Instantaneous Trip Point	Nameplate Rating, Amp. Continuous
100 Ampere Frame Size		
7– 9	8	1
11– 13	12	5
19– 21	20	7
30– 34	32	12
47– 53	50	20
76– 84	80	25
119– 132	125	35
190– 210	200	70
300– 330	315	70
475– 525	500	100
650– 720	685	100
905–1,000	950	100
1,235–1,370	1,300	100
225 Ampere Frame Size		
950–1,050	1,000	225
1,425–1,575	1,500	225
1,710–1,890	1,800	225
600 Ampere Frame Size		
1,710–1,890	1,800	600
2,470–2,730	2,600	600
3,420–3,780	3,600	600
4,560–5,040	4,800	600

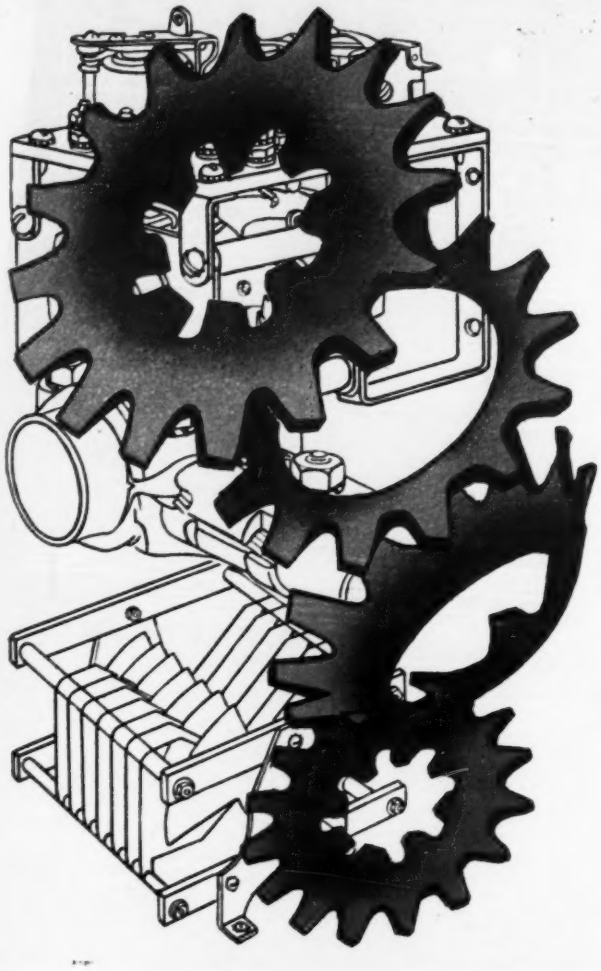
Table 3. Code for Motor Kva Input per H.P. with Locked Rotor

A	0– 3.14	J	7.1 – 7.99
B	3.15– 3.54	K	8.0 – 8.99
C	3.55– 3.99	L	9.0 – 9.99
D	4.0 – 4.49	M	10.0 –11.19
E	4.5 – 4.99	N	11.2 –12.49
F	5.0 – 5.59	P	12.5 –13.99
G	5.6 – 6.29	R	14 and up
H	6.3 – 7.09		

Product improvement through

BRIDGEPORT'S IMPROVED PHOSPHOR BRONZE

FOR LOCK WASHERS WITH LASTING SPRING QUALITIES



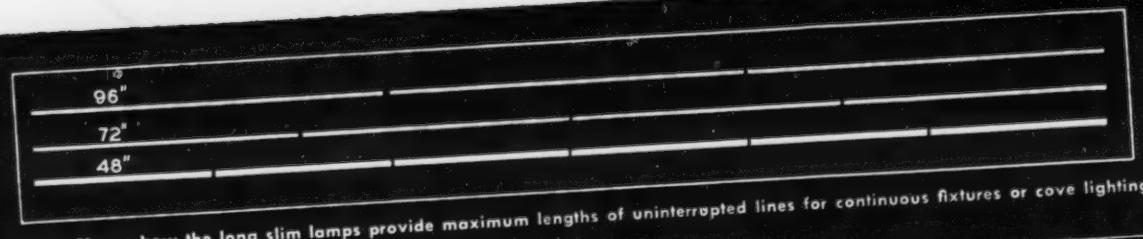
Phosphor bronze lock washers play a vital part in relays, switches, generators, controls, transformers, amplifiers, condensers, transmitting and receiving assemblies, and in many types of electrical equipment and various electrical appliances. They assure protection against breaks in electrical connections, "shorts" and other product failures by providing positive connections not loosened by vibration.

Bridgeport's Improved Phosphor Bronze is used in the manufacture of famous "Shakeproof" lock washers, which must retain lasting spring qualities under pressure. Properties such as freedom from cracking in service, toughness, resistance to severe corrosion and ease of manufacture are also required.

Bridgeport's Improved Phosphor Bronze has earned the confidence of many of America's leading designing engineers and manufacturers interested in using better and more dependable materials for engineering applications. Your nearest Bridgeport Technical Advisor will be glad to discuss with you problems which require modern copper base engineering alloys.

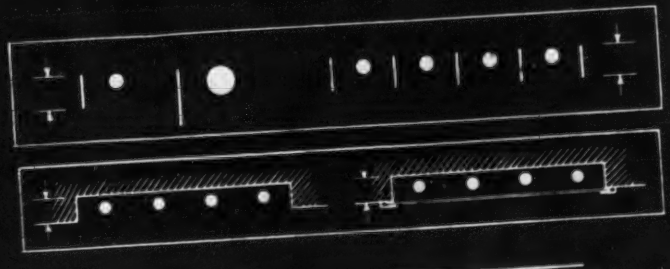
BRIDGEPORT
Phosphor Bronze
A PRODUCT OF
"Bridgeport" BRASS CO.
BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. · Established 1865

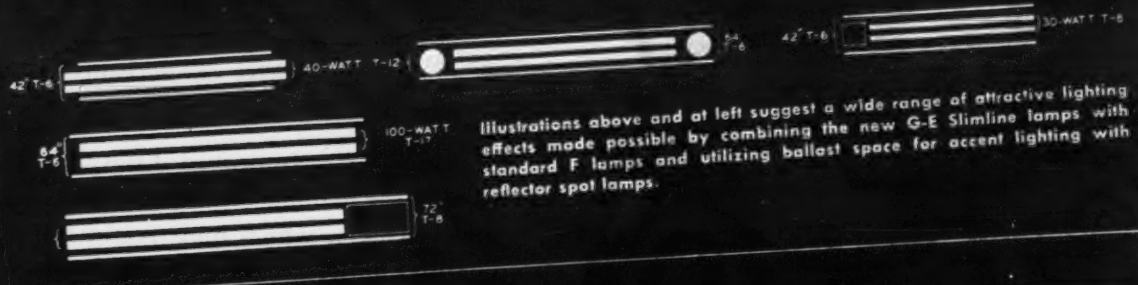
practical facts



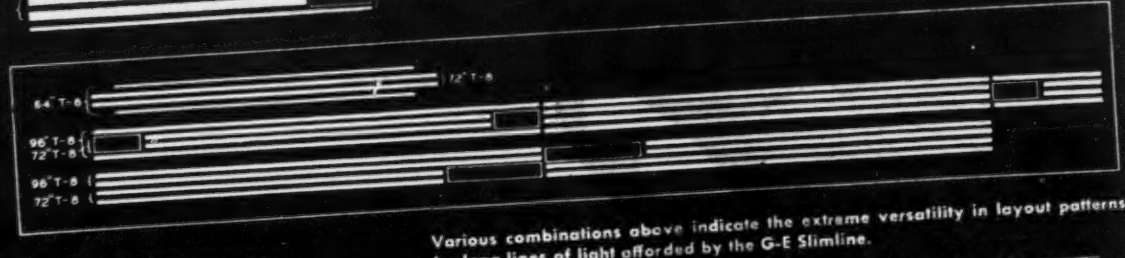
Above: Shows how the long slim lamps provide maximum lengths of uninterrupted lines for continuous fixtures or cove lighting.

Right: These two sectional views illustrate minimum space requirements of the G-E Slimline. Top view compares the new lamps with standard G-E Mazda F lamps in the same shielding. Second view shows two recessed panel sections.

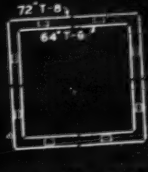


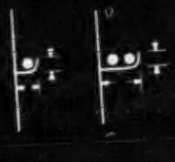


Illustrations above and at left suggest a wide range of attractive lighting effects made possible by combining the new G-E Slimline lamps with standard F lamps and utilizing ballast space for accent lighting with reflector spot lamps.



Various combinations above indicate the extreme versatility in layout patterns for long lines of light afforded by the G-E Slimline.





Comparative views above show how the long slim lamps permit minimum dimensions for shelf lighting, cornices, coves or case tops. View at right above demonstrates how control of light is facilitated for show windows and displays.

Above: Illustrates how the "custom" treatment of various sized areas can be achieved with G-E Slimline lamps.

G-E SLIMLINE MAZDA FLUORESCENT LAMPS

Lamp	Nominal Length* (Inches)	Max. Over-all Length of Lamp (Inches)	Bulb**	Current (Milliamperes)	Lumens (Approx.)
42T6	42	40	T-6	100	900
				290	1400
64T6	64	62	T-6	100	1400
				200	2150
72T8	72	70	T-8	100	1400
				290	2350
96T8	96	94	T-8	100	1950
				200	3300

* Nominal length includes one lamp plus two multiple sockets. When series sockets are available, the increase in over-all length will be announced.

** T-6 is ¾" outside diameter (approx.)
T-8 is 1" outside diameter (approx.)

KEEP BUYING WAR BONDS—KEEP THE WAR BONDS YOU BUY

about a new and versatile lighting tool . . .

G-E Slimline Fluorescent lamps*

A RECENT announcement presented the latest achievement of General Electric's lamp research—The new G-E SLIMLINE Mazda Fluorescent Lamps! These four long, slim G-E fluorescent lamps—up to eight feet in length—provide an extremely versatile and flexible light source for countless lighting applications.

To keep the lighting industry fully informed on new light sources, to facilitate design and planning, and to meet the needs of expanding lighting markets . . . complete information on the G-E SLIMLINE has been presented below. Suggested ideas for new lighting installations are shown at left.

UNIQUE FEATURES

1. Smaller diameter and longer length for slim lines of light.
2. High degree of flexibility in brightness values and lumen output is possible through operation of lamps over a variable range of wattages and current values —from 100 to 200 milliamperes.
3. Instant starting without starters.
4. Operation singly, in multiple or in series.

HIGHER EFFICIENCY

1. Initial light output—average of 60 lumens per watt.
2. For a given color, the longest lamp is 25% more efficient than any type or size of fluorescent lamps heretofore available from any source.
3. Minimum dark space at the ends.

IMPROVED DESIGN

1. Four different lengths—42″, 64″, 72″ and 96″ —for general illumination, concealed lighting, and all types of special applications.
2. Single pin base makes possible a safe design of lamp and socket for multiple operation.
3. Reduced cross-sectional area—approximately half the diameter of standard G-E Mazda F lamps.
4. New cathode developed especially for G-E Slimline Lamps results in long lamp life.

AVAILABILITY

1. Limited quantities of sample lamps in the 42″ and 64″ lengths, white only are now available. Other sizes will be available later.
2. Quantity production will proceed as soon as conditions permit.

***NEW G-E SLIMLINE PRICES JUST ANNOUNCED**

42T6-$1.55; 64T6-$1.75;
72T8-$2.00; 96T8-$2.70.

These prices subject to taxes.

G-E MAZDA LAMPS

GENERAL ELECTRIC

Hear the G-E radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, Monday through Friday 6:45 p. m. EWT, CBS; "The G-E Houseparty," Monday through Friday 4:00 p. m. EWT, CBS.

CORRECTION OF TEMPERATURE MEASUREMENT ON SHORT CONDUCTORS

By JEROME J. TAYLOR, The Detroit Edison Co., Detroit, Mich.

Compensation for hot or cold terminals on a sample or test section of a wire, cable or bus can be made for the temperature rise at the midpoint of the section and thereby correct the temperature measurement, the resultant being an equivalent for a very long conductor. Accompanying data is used in determining the amount by which the midpoint temperature should be corrected. Examples are included and supplement the engineering idea ("Electrical World", November 25, 1944, page 98) developed by the author.

Example 1

Given: A load test has been made on a 1½-inch diameter, taped, solid copper bus, of which a 10-foot section was the longest accessible portion. Measured temperatures were 60 deg. C. at the midpoint of this section, and 44 deg. C. and 56 deg. C. at the ends. Current was 1,400 amp. and air temperature in the compartment was 30 deg. C.

Problem: What was the maximum probable temperature in a longer section of this bus?

Solution: Since the bus was inclosed, natural air circulation is restricted and the attenuation should be calculated as described in the previous article (ELECTRICAL WORLD, Nov. 25, 1944, page 98) instead of taken from the table.

$$a = [(0.00012) \times (1{,}400)/(1.767)] \times [\sqrt{(663 + 2.82 \times 60)/30}]$$

$=0.49$, approximately, per foot. For the whole test section the attenuation was therefore 4.9, and from the curve the corresponding correction factor is found to be 0.2. Average difference between midpoint and terminals was 60 minus (44 plus 56)/2=10 deg. C., so a longer section of this bus would have a probable maximum temperature of 60 plus 0.2(10), or 62 deg. C.

Example 2

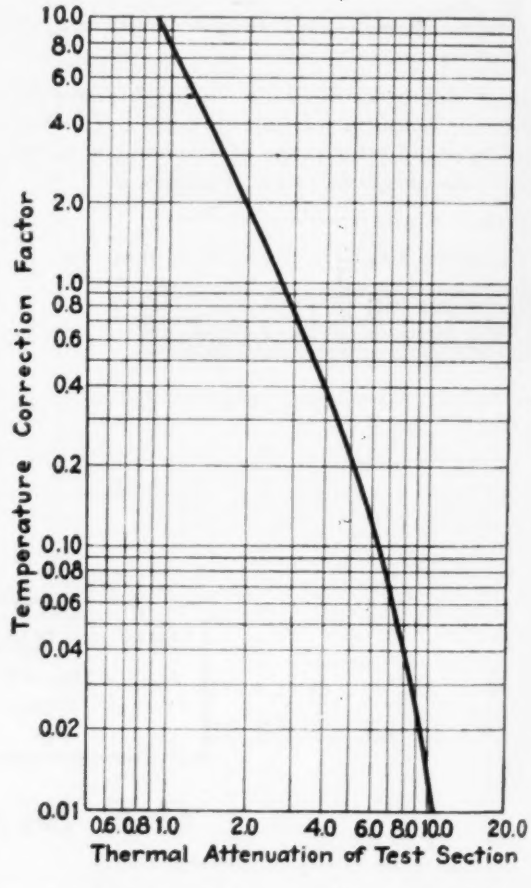
Given: A piece of No. 1/0 copper transmission wire is to be tested to find what current it will carry in a 2-m.p.h. wind without exceeding 100 deg. C. rise. Current is to be supplied from a large transformer whose terminals will probably remain close to the ambient temperature.

Problem: What minimum length of sample is required if the midpoint temperature is to be representative of a long line?

Solution: From the table, the probable attenuation for a No. 1/0 conductor in a 2-m.p.h. wind is 2.2. Difference between midpoint and terminal temperatures will be nearly 100 deg. C., so the correction factor must be 0.01 or less if the midpoint reading is to be within a degree of the correct value. From the curve the attenuation must therefore be at least 11, so the minimum sample length is 11/2.2, or 5 ft.

Representative Attenuations Per Foot of Bare Copper Conductor

Conductor Size	Air Cooling							
	Natural Convection, Deg. C. Rise				Forced Convection, Wind Velocity, m.p.h.			
	30	60	100	150	1	2	5	10
No. 10	3.0	3.3	3.5	3.8	3.9	4.6	5.7	6.8
8	2.6	2.8	3.0	3.2	3.3	3.9	4.9	5.8
6	2.2	2.5	2.6	2.8	2.9	3.4	4.3	5.1
4	1.9	2.1	2.3	2.4	2.5	2.9	3.7	4.6
2	1.7	1.9	2.0	2.1	2.2	2.6	3.3	3.9
1/0	1.5	1.6	1.7	1.8	1.9	2.2	2.8	3.3
3/0	1.3	1.4	1.5	1.6	1.7	2.0	2.4	2.9
250 Mc.m.	1.1	1.2	1.3	1.4	1.5	1.7	2.2	2.6
350 Mc.m.	1.0	1.1	1.2	1.3	1.3	1.6	2.0	2.3
500 Mc.m.	0.91	1.0	1.1	1.1	1.2	1.4	1.8	2.1
750 Mc.m.	0.80	0.89	0.95	1.0	1.1	1.2	1.5	1.8
1000 Mc.m.	0.74	0.82	0.88	0.93	0.96	1.1	1.4	1.7
¼" x 4"	0.68	0.76	0.81	0.86	0.89	1.0	1.3	1.6
2250 Mc.m.	0.58	0.64	0.68	0.73	0.76	0.89	1.1	1.3
4000 Mc.m.	0.48	0.54	0.58	0.61	0.64	0.76	0.94	1.1

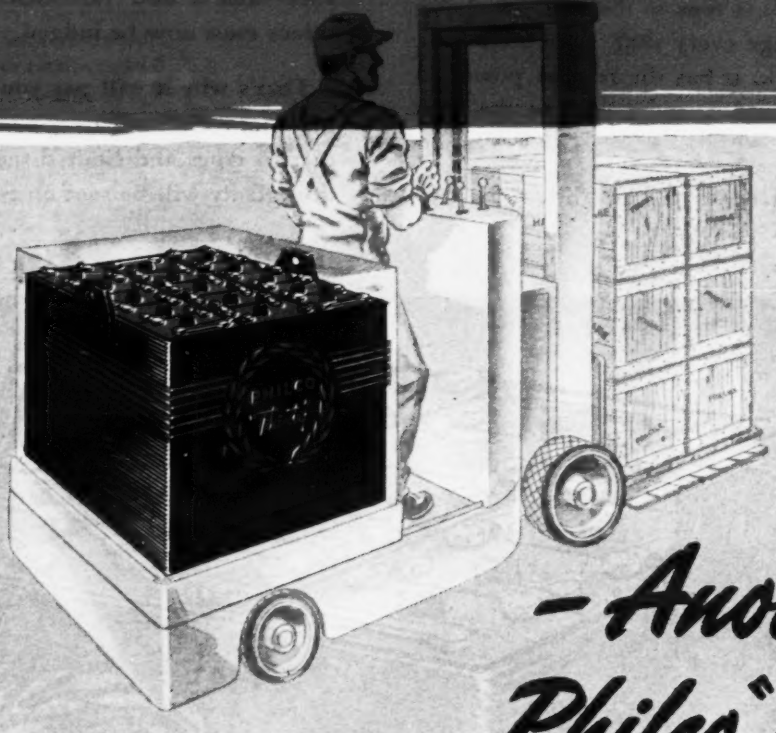


CURVE GIVES FACTOR for correcting midpoint temperature. Thermal attenuation of test section is equal to section length in feet multiplied by attenuation per foot of bare copper conductor in table.

PHILCO

Again in the News

THE BATTERY THAT GIVES 30% LONGER LIFE



–Another Philco "First"

Revolutionary new

PHILCO "THIRTY"

WITH 30% LONGER LIFE RADICALLY CUTS MOTIVE POWER BATTERY COST!

★ *Reduces depreciation and maintenance*
★ *Gets more work done*
★ *Packs a terrific wallop*

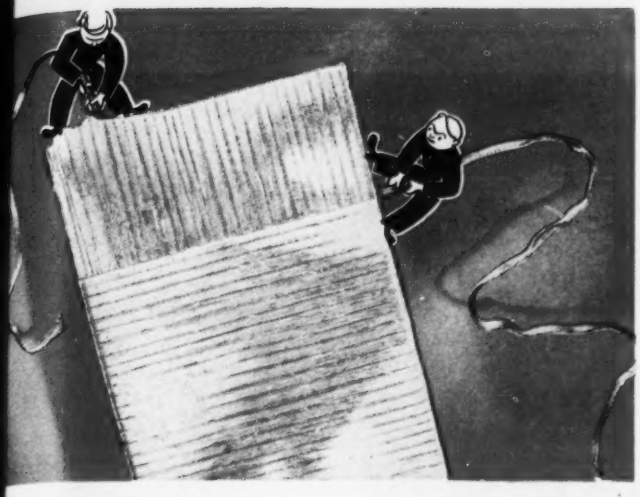
What every materials handling man wants in a storage battery is **packed** into this amazing new Philco "Thirty."

In high capacity, it is **tops** in the field—assuring the maximum tonnage every shift. Even after long hours of heavy work, it has the reserve power to climb ramps and grades, and complete the shift in *high*.

But the feature which sets the new Philco "Thirty" entirely apart from all other batteries you have known, used, or even heard of before—is its phenomenal long life. **30% longer life**—often more—has been demonstrated time after time in exhaustive field tests.

Here, then, is more than just a new and better battery. Here is a new standard of battery performance—*and* a new yardstick by which all battery values must now be judged.

That's why it will pay you to get posted on this great new Philco Battery which is now available in certain types and limited quantities. Full information gladly will be sent on request.

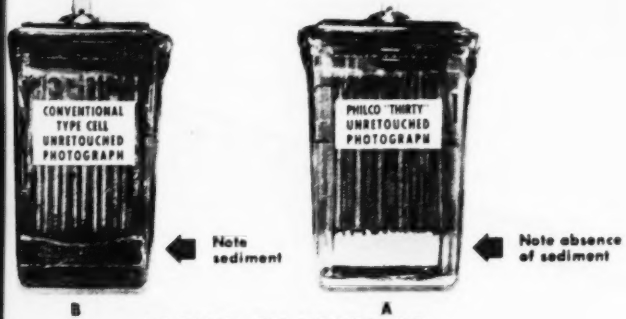


EVOLUTIONARY NEW PRINCIPLE OF PHILCO FABRICATED INSULATION*

Only PHILCO "THIRTY" has it!

Here is a brand-new construction principle *and* an ultra-modern application of a proven insulating material. Both the results of Philco pioneering! This material is fabricated glass tape wrapped around the positive plates in two layers, first vertically and then horizontally. Even a single layer of this glass tape insulation has been found to have better retentive power in holding the active material in the plate, than the standard glass mat! And—of course, the plates of the Philco "Thirty" are further protected and insulated with the time tested Philco slotted rubber retainer and rubber separator. **Patent applied for*

YOU GET IT FIRST WITH PHILCO



PROVED BY YEARS OF FIELD AND LABORATORY TESTS

As proved in scores of service tests, these unretouched photographs show what happens when a Philco "Thirty" cell (A) and a conventional type cell (B) are tested side by side in motive power cycle service, charged and discharged in series in the same circuit. Glass jars were used here only to permit observation. Note almost total absence of sediment in the Philco "Thirty", while the sediment space of cell B is filled. Cell B has delivered its normal life expectancy and is worn out—while the Philco "Thirty" still delivers over 100% of rated capacity, with a long margin of serviceable life still to go.

THE CLIMAX OF 50 YEARS OF LEADERSHIP IN BATTERY RESEARCH AND ENGINEERING

The procession of Philco "Firsts", covering the whole field of motive power and stationary batteries, has set the pace in modern battery design. Check the developments, which have contributed most to today's higher capacities, increased efficiency, longer life, and lower cost—the record shows *you get it first with Philco.*

PHILCO VITRABLOC

A development for telephone, control and standby service, that materially increases battery room capacities.

PHILCO FLOTÉ

The battery that exerted a major influence on the wider use of full float service, by eliminating low cells. More efficient . . . more economical to maintain.

PHILCO HIGH CAPACITY CELLS

Through modern plate design, Philco showed the way to increased capacity without increase in over-all battery dimensions. A tremendous advantage in many motive power operations.

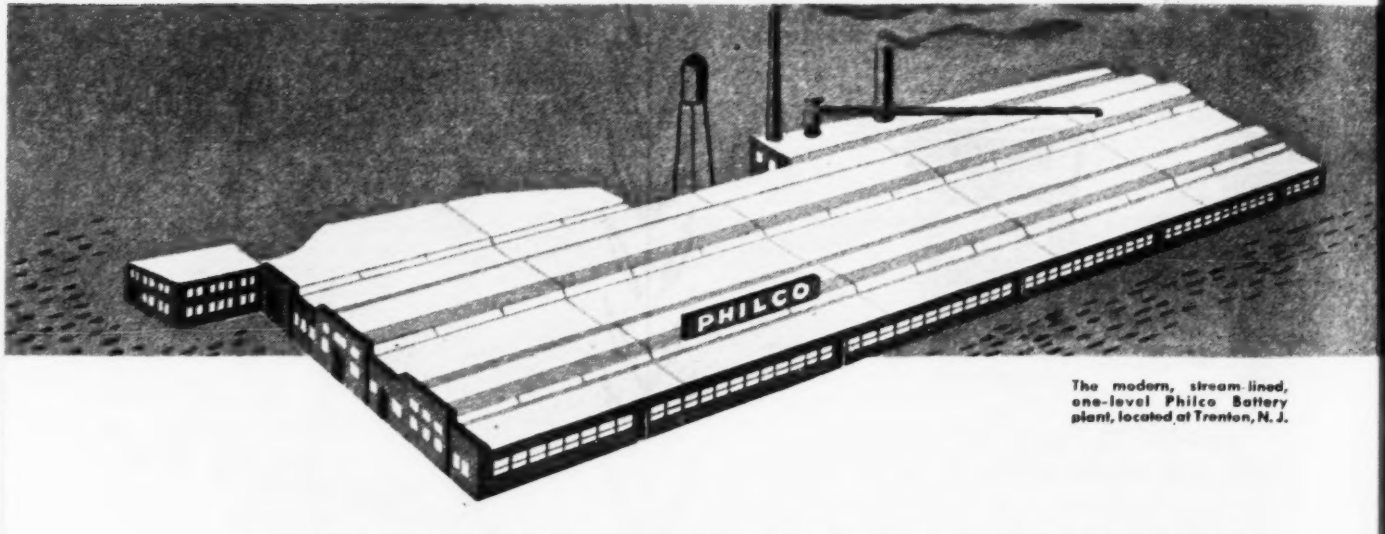
PHILCO

BUILT FOR MODERN DEMANDS BY THE LEADER IN MODERN BATTERY ENGINEERING

As described in the foregoing pages, Philco is ready, today, with the advanced battery performance and long-life economy you'll need in your post-war operations. With model manufacturing facilities, Philco is ready to produce these superior batteries in greater volume than ever before.

In the complete Philco line are modern storage batteries for all industrial applications—industrial trucks, mine locomotives and shuttle cars, diesel starting, railroad car lighting and air conditioning, control and power, telephone service and signal systems.

On your next purchase of batteries specify a modern Philco.



The modern, stream-lined, one-level Philco Battery plant, located at Trenton, N. J.

PHILCO CORPORATION

STORAGE BATTERY DIVISION · TRENTON 7, NEW JERSEY

For 50 Years a Leader in Industrial Storage Battery Development

HOW TO DETERMINE ALLOWABLE VERTICAL LOADING ON CROSSARMS

By PHILIP MORRILL, Windham, New Hampshire

alues in table apply to either best rade of fir or creosoted southern ine. They cover actual vertical load hich may be applied at each pin with ll pins occupied, without exceeding 0 percent ultimate strength of fiber 5,000 lb. per sq. in. Weight of 25-lb. lineman at end of arm has een taken into account.

In values over 2,000 lb. total for all ins on one arm or double arming, the gures and strength of crossarm may ex- ed bearing value of through-bolt and unsymmetrically loaded exceed the rength of crossarm braces. The bear- g value of through-bolt will vary with he diameter of pole. See "How to Determine Size of Through-Bolts for Poles," ELECTRICAL WORLD, May 29, 1943, age 88.

Climbing space between center pins required by code. This should be not less than 24 in. for communication circuits and feeders of less than 300 volts, 30 in. for feeders up to 8700 volts and 36 in. for feeders up to 15,000 volts.

On buckarm poles, if normal straight line construction is used, the climbing space is reduced. This may be avoided by using crossarms two pins longer so the wires may be carried on the outside pins and the pins nearest center left vacant.

On lines up to 8700 volts it is also permissible to use standard line crossarm and place pin between two outside pins, giving a spacing of 7¼ in. in place of 14½ in. on EFI crossarms. This arrangement is permitted only if poles on each side of this pole have standard pin spacing. Both types of buckarms are covered in the table.

Example—A circuit is designed as follows: 2/01 TBWP conductors, 4160 volts, 3 phase, heavy loading district, 150 ft. spans. Another circuit of smaller conductors is to be carried on other side of crossarm, so six-pin crossarm is preferred. With standard pin spacing of 14½ in. for short spans an 8-ft. EEI cross arm is indicated.

From loading tables for 2/0 TBWP copper wire in heavy loading district, the vertical weight per foot of wire with ½ in. of ice is 1.245 lb. Then 150 x 1.245 equals 187 lb. load at each pin.

From accompanying loading table: (1) A 3¼ x 4¼ in. x 8 ft. EEI crossarm with holes for wood pins is suitable for 126 lb. maximum. (2) A 3½ in. x 4½ in. x 8 ft. EEI crossarm with holes for wood (or steel) pins is suitable for 205 lb. maximum.

The value in item (2) appears to be satisfactory. Also when that design of crossarm is mounted singly on poles the maximum span that can be used is 205/1.245 or 165 ft.

Allowable Vertical Loading on Crossarms at Pins

(1) Arm Length, ft-in.	(2) No. of Pins	(3) Center Space, in.	(4) Pin Space, in.	(5) End Space, in.	Crossarm Loading: Wood (6) Pin Hole, in.	Wood (7) Load, lb.	Steel (8) Pin Hole, in.	Steel (9) Load, lb.
2¾ in. x 3¾ in. Pony Telephone Crossarms								
2—0	2	17	—	3½	1⅝	1560A	⅝	1560A
2—6	2	23	—	3½		1100A		1100A
1—0	2	29	—	3½		825A		825A
1—6	4	16	9½	3½		440A		440A
5—2	6	16	9¾	3½		116B		170A
4—10	8	16	9¾	3¾		20B		75A
3—6	10	16	9¾	4		32BC		34A
10—0	12	16	9⅝	3⅞		8.7BC		13A
3 in. x 4¼ in. R. S. A. Crossarms								
6—0	4	20	22	4			⅞	340A
5—0	6	19	17½	4				140A
10—0	8	19	15½	4				75B
10—0	10	16	12¾	2½				53B
3 in. x 4¼ in. Western Union Crossarms								
6—0	6	20	11½	3			⅞	225A
4—0	8	21	11½	3				100A
10—0	10	22	11½	3				50A
3¼ x 4¼ in. Electric Light Crossarms								
3—0	2	28	—	4	1⅞	1450A	⅛	1480A
4—0	4	16	12	4		680A		680A
3—0	4	18	17	4		500A		500A
1—0	4	22	21	4		380A		380A
4—0	6	16	12	4		185B		270A
4—0	4	16	24	4		275B		400A
4—0	6	18	17½	4		75B		170A
4—0	4	18	35	4		120B		255A
5—0	8	16	12	4		50B		130A
5—8	4	40	24	4		210A		210A
3—6	10	16	9¾	4		32B		95AB
1—6	4	35½	29½	4		150B		200A
3—0	8	17½	15¾	4		14B		85AB
3—0	4	49	31½	4		135A		135A
3—0	10	16	12	4		11B		65AB
3—0	4	40	36	4		110B		140A
10—0	12	16	9⅝	3⅞		8B		55AB
3¼ x 4¼ in. Pacific Crossarms								
3—0	2	28	—	4	1⅞	1450A	⅛	1450A
5—0	4	28	12	4		440A		440A
5—0	6	28	12	4		190A		190A
7—0	4	28	24	4		275AB		275AB
8—0	8	28	12	4		50B		95A
8—0	4	52	24	4		160A		160A
11—0	10	28	12	4		10B		50A
11—0	4	52	36	4		108A		108A
3¼ x 4¼ in. New England Crossarms								
3—0	2	30	—	3	1⅛	1360A	⅛	1360A
5—6	4	30	13½	4½		390A		390A
7—9	6	30	13½	4½		140B		160A
10—0	8	30	13½	4½		32B		75A
7—9	4	30	27	4½		200B		240A
10—0	4	57	27	4½		200B		130A
3¼ x 4¼ in. EEI Crossarms								
3—2	2	30	—	4	1⅛	1360A	⅛	1360A
5—7	4	30	14½	4		365A		365A
8—0	6	30	14½	4		126B		150A
8—0	4	30	29	4		190B		230A
9—2	8	30	12	4		54B		90A
9—2	4	54	24	4		157A		157A
9—2E	6	54	12	4		103A		103A
8—0	6	59	7¼	4		68AD		68AD
3½ x 4½ in. EEI Crossarms								
3—2	2	30	—	4	1⅛	1680A	⅛	1680A
5—7	4	30	14½	4		490A		490A
8—0	6	30	14½	4		205AB		205AB
8—0	4	30	29	4		315AB		315AB
8—0	6	59	7¼	4		92AD		92AD
9—2	8	30	12	4		100B		128A
9—2	4	54	24	4		225A		225A
9—2E	6	54	12	4		145A		145A
3½ x 4½ in. TVA—REA Crossarms								
4—0	2	40	—	4	1⅛	1200A	⅛	1200A
8—0	2	88	—	4		400A		400A
10—0	2	108	—	6		300A		300A
3¾ x 4¾ in. New England Power Crossarms								
3—0	2	30	—	3	1⅛	2070A	⅛	2070A
5—6	4	30	13½	4½		630A		630A
7—9	6	30	13½	4½		285A		285A
7—9	4	30	27	4½		430A		430A
10—0	8	30	13½	4½		132B		150A
10—0	4	52	27	4½		275A		275A
3¾ x 4¾ in. Transmission Structure Crossarms								
10—0	4	38	36	5	—	———	⅛	294A
4¾ x 5¾ in. TVA Crossarms								
10—0	2	108	—	6	1⅛	960A	⅛	960A
10—0	4	40	34	6		700A		700A

A — Maximum fiber stress occurs at through-bolt hole.
B — Maximum fiber stress occurs at pin hole nearest pole.
C — This value is at 75 percent ultimate strength allowable only where used previously and in dry arid regions.
D — Spacing for climbing on buckarm poles. This is allowable only when arms on poles on each have 14½-in. pin spacing.
E — Standard pin spacing for buckarm poles.

Cleaner Solves Air Preheater Problems

Need for securing maximum heat recovery from current low-grade fuels has brought with it new problems of air preheater operation. In order to increase fuel efficiency at all operating rates, many boiler plants are today being operated with lower gas outlet temperatures from their preheaters. While this increases heat recovery, it also increases the possibility of the formation of deposits on the cold end of the heating surface. This is particularly true where plants are using fuels differing from those for which the plant was originally designed. In the overall economic balance, it may be preferable to accept a certain amount of deposit formation for the sake of extra heat savings, provided it can be easily and efficiently removed without shutting down the unit.

The Air Preheater Corp., New York City, has solved this problem by developing a new cleaning device for all types and sizes of the Ljungstrom Air Preheater which is simple and easy to operate. This cleaner, a single-nozzle device, operates on the mass blower principle.

It blows out the flow-retarding deposits as it is moved, either manually or mechanically, over the heating surface of the preheater. Although steam is generally used, compressed air and hot water are usable as cleaning agents, depending upon the nature and thickness of the deposits. The preheater is cleaned while it is in operation; no shutdown is necessary.

In addition to its ability to use various cleaning mediums, the new single-nozzle cleaning device has other technical features. The cleaning device is located at the cold air inlet side of the preheater, in order to get maximum cleaning where the deposits are heaviest, and to increase the force of the blow by causing it to take place in the direction of air flow through the preheater. This also prevents condensation by applying maximum steam energy and temperature where the metal temperature of the preheater is lowest, and plates are advancing into temperatures in excess of the 200-deg. condensation point.

This cleaner has, for the past six months, kept a double-height preheater, which was in continuous operation with exit-gas temperatures below the dew point, completely free from deposit formation.

•

Oils and Lubrication of Steam Turbines—VII*

7. Procedure of Reconditioning—Centrifugal Treatment

By J. A. TRISKA
Technical and Research Division
The Texas Co., New York City

Centrifuging improves the stability of a turbine oil in service by removing undissolved contaminants or foreign matter. Centrifuging involves the same basic principles as settling and decantation, but is faster because the separating force is several thousand times that of gravity.

The centrifuge effectually frees an oil of suspended insoluble oxidizing material, foreign mineral matter, dirt and water as well as some of the soluble oxidation products. The latter applies chiefly, however, to mineral acids or those organic acids which are more soluble in water than oil. These may be removed if water is added along with the oil being centrifuged.

A centrifuge will not separate liquids which are mutually miscible. As with settling and decantation, separation of oil contaminants is made according to gravity, accelerated by centrifugal force, and is effective with any oil containing such impurities.

The term "capacity," as applied to a centrifuge, often is used loosely. A centrifuge may be said to have two capacities:

1. Through-put capacity, which is the total quantity of oil that can be put through the machine regardless of the degree of purification effected and without overflowing.

2. Effective capacity, which is the quantity of oil that can be put through the machine with the desired degree of purification.

Factors Affecting Capacity

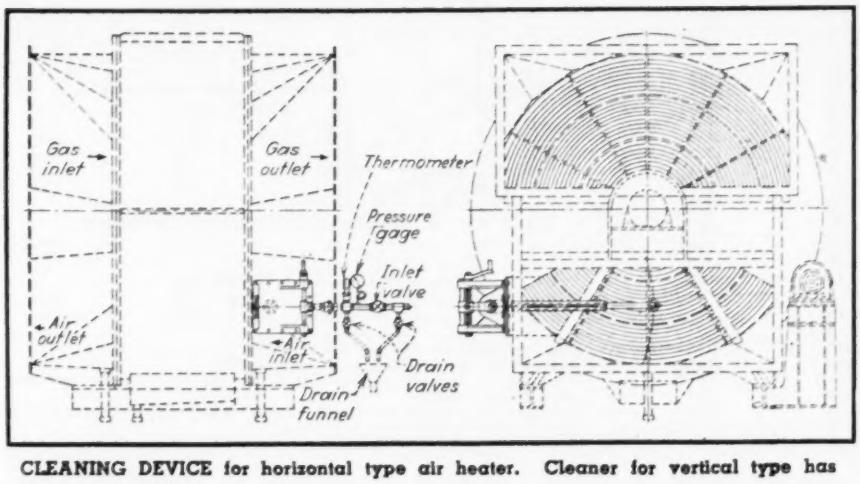
Effective capacity, generally, has no relation to through-put capacity, but it is of chief interest to the turbine operator. Effective capacity depends upon used oil viscosity; temperature; amount, size and weight of impurities; degree of purification desired; and persistency of emulsion if water is present.

An oil purification centrifuge should always be set to operate by the two-liquid discharge method. This does not necessarily mean that water should be added at the centrifuge, but the discharge opening should be provided to emit any water which may be in the oiling system.

Centrifuging is often referred to as "wet" or "dry" according to whether or not water is intentionally added to the oil at the centrifuge. Sometimes this is inconvenient and somewhat dangerous, but when it will work, cleaner oil will result from the addition of water to the oil at the centrifuge. Centrifuging "wet" has the following advantages:

1. The washing effect of water aids in the removal of impurities.

2. The water carries away the lighter impurities which have a gravity approximately that of water, permitting longer runs between cleanings.

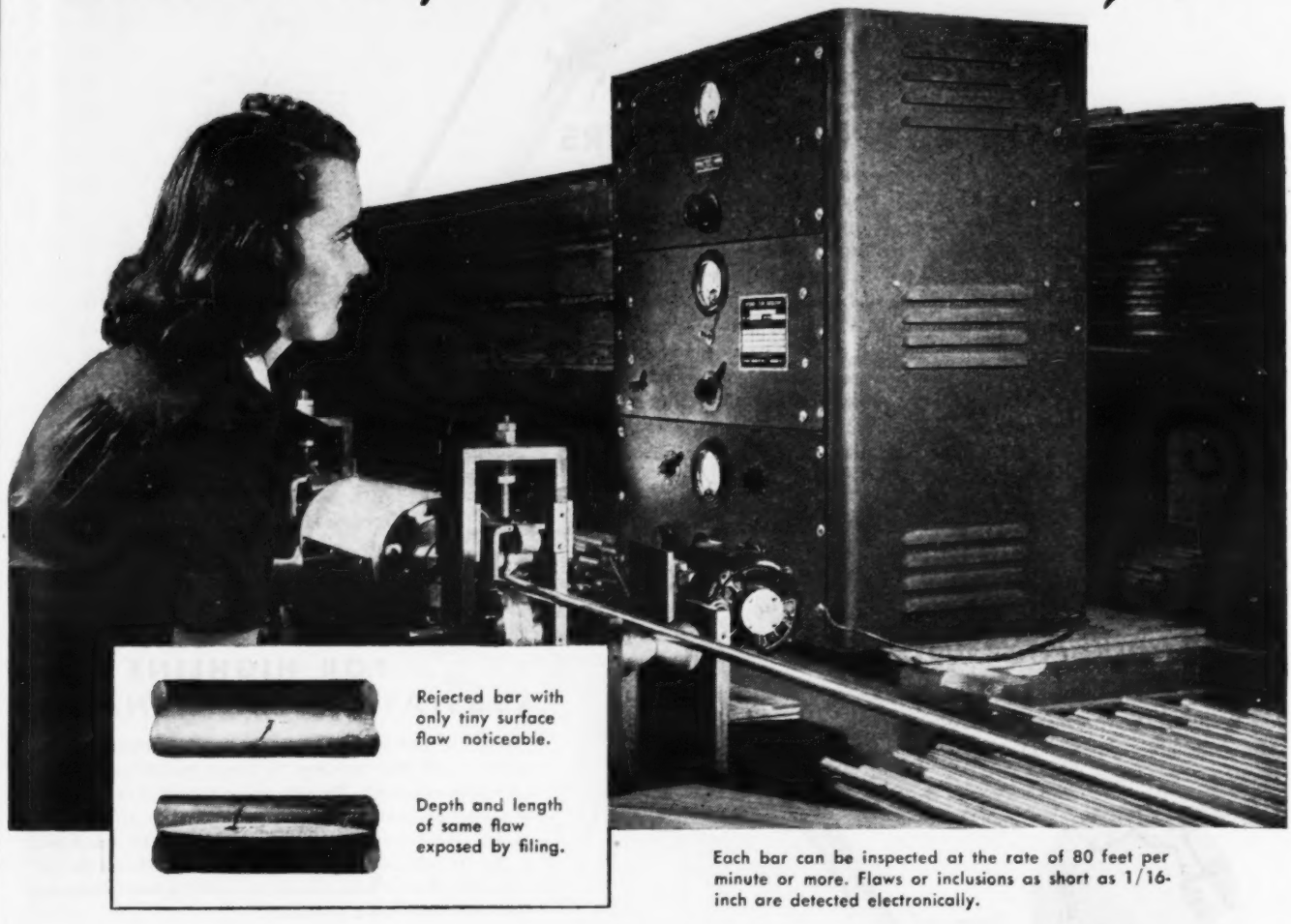


CLEANING DEVICE for horizontal type air heater. Cleaner for vertical type has same characteristics

* This series began in the ELECTRICAL WORLD, September 30, page 93.

SPERRY ELECTRONIC FLAW DETECTOR

saves $2000 per week in tool breakage!



Rejected bar with only tiny surface flaw noticeable.

Depth and length of same flaw exposed by filing.

Each bar can be inspected at the rate of 80 feet per minute or more. Flaws or inclusions as short as 1/16-inch are detected electronically.

How RCA Electron Tubes Help Locate Hidden Flaws in Bar Stock

THIS is the story of a New England manufacturer* who used electronic inspection to solve his problem of excessive tool breakage.

In machining parts from brass bar stock, invisible flaws and inclusions in the brass caused tool breakage costing over $2000 per week.

To solve the problem, an electronic flaw detector, developed and manufactured by Sperry Products, Inc., Hoboken, N. J., was purchased to inspect all stock before machining. The new inspection method detects defects which would cause tool damage and resulting shut-down. In the first six weeks of operation, *not one tool was broken, tool wear was sharply reduced, and production increased 60%!*

How Does It Work? The Sperry electronic flaw detector consists of an electron-tube oscillator, a detector coil, and a sensitive electron-tube indicator. The oscillator supplies alternating current to the detector. The brass is passed through the detector (see photo). If a flaw is present, the indicator circuit signals the operator and stops the machine. Seventeen small RCA electron tubes are used.

*Name on request

Defects as short as 1/16-inch can be located in both ferrous and non-ferrous materials. The detector works equally well on welded or seamless tubing and on bar stock, and locates external or internal defects, such as splits, seams, and inclusions.

Advantages: In addition to preventing damage to tools and machines, automatic electronic detection improves product quality, reduces final inspection rejections, and prevents failures in the field caused by defective material.

For Further Information on the electronic flaw detector write to Sperry Products, Inc., Hoboken, N. J. If you have some *other* problem involving the use of electron tubes, RCA tube application engineers will be glad to help you or to put you in touch with a manufacturer who can.

For a copy of the free 32-page booklet "Electrons in Action at RCA" which shows electronic devices at work in our own factories, write to Radio Corporation of America, Dept. 62-18W, Harrison, N. J.

Remember, the Magic Brain of all electronic equipment is a Tube . . . and the fountain-head of modern Tube development is RCA!

1919-1944
25 Years of Progress in Radio and Electronics

RCA

BUY WAR BONDS

62-6331-18

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

TIPS hot line tools that save on odd jobs...

INSULATED LEVER TYPE WIRE CUTTERS

Occasionally it is necessary for hot line maintenance crews to cut conductors, tie wires, jumpers, etc. This lever type wire cutter has proven itself to be a popular item for such jobs because it is easy to handle, has a leverage ratio of four to one, and is voltage tested to withstand 75,000 volts per foot. The pole is laminated to stand a heavy load without excessive bending and with no danger of breaking. The pull-rod is laminated plastic of high diaelectric strength. The cutter is available in regular and heavy duty types with four or six-foot poles. The regular has a maximum cutting capacity of 2/0 weather-proof, solid copper or 2/0 bare ACSR. The heavy duty cutter will cut 2/0 weather-proof stranded copper, 4/0 bare stranded copper and 4/0 bare ACSR.

ALL-ANGLE "COG" WRENCH

The Tips All Angle Cog Wrench operates at any position within a 140° vertical arc. This close-up shows the cog mechanism, the wing nut adjustment and the application of the side lever.

FOR HIGHLINE AND SUBSTATION MAINTENANCE

This tool is especially handy for use on clamp top insulators and a variety of jobs where nuts need tightening around buses or other sub-station equipment. The wing nut on the side of the head may be tightened to hold the head at any definite angle. The small rod on the side is a thumb operated lever which holds the wrench head in any desired position until the socket is fitted over the nut. Nuts are turned by simply turning the pole. Cog wheel mechanism turns the socket in all positions.

This wrench is made to fit any standard socket with 1½" recess. However, a complete line of deep throated sockets are obtainable with the wrench. The tool is tested to withstand 75,000 volts per foot. Made in four-foot and six-foot lengths.

DAMPER TOOL FOR HANGING STOCKBRIDGE DAMPERS "HOT"

Vibration troubles can be remedied safely and without service interruptions by the application of Stockbridge vibration dampers with the Tips Damper Tool. This tool not only permits hanging dampers while conductors are energized but also provides a convenient means for handling this job, making it possible to hang dampers much faster on conductors that are hard to reach. Dampers are screwed up tight by turning the pole. Poles are tested to withstand 75,000 volts per foot.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC Hot Line Industries

CONSULT YOUR TIPS TOOL CATALOG

TIPS TOOLS

3. Some acids which are apt to form in lubricating oil are more soluble in water than petroleum oil and are thus removed, reducing oxidation catalysis.

The objections to centrifuging "wet" include:

1. Due to the greater density of water, the water discharge must be lower than the oil discharge to permit water to flow out of the centrifuge. Therefore, if the water seal breaks, oil will flow out of the lower water discharge instead of the oil discharge. If not noted by the operator or if safety devices are not installed, the centrifuge may take all of the oil out of the system since the centrifuge should take suction from the bottom of the tank through a sight overflow which is designed to prevent lowering of the oil level.

2. If periodic cleaning of the centrifuge is neglected, the discharge outlets may plug up, causing the centrifuge to fill with water which will pass to the turbine system through the clean oil discharge.

3. Clean oil and water will not ordinarily emulsify. If the oil becomes unusually dirty, emulsion may occur, the addition of water in such cases should be discontinued.

In a centrifuge bowl during operation, a ring of oil is formed surrounded by a ring of water. The circular metal ring on top of the bowl prevents that portion of the water under it from overflowing. The wider this ring or water dam, the wider the ring of water in the centrifuge bowl. The dividing line between oil and water, called the "water line," is not directly beneath the inside edge of the water dam because it is pushed outward by the centrifugal force of the oil underneath the dividing wall.

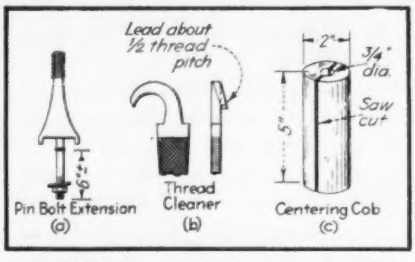
•

Adapt Tower Pins for Wooden Arms

A preference for steel insulator pins in the transmission department of the Iowa Power & Light Co., Des Moines, went unsatisfied during the war until a short time ago when a number were reclaimed from an old steel tower transmission line.

Task of converting these pins for use on wooden transmission crossarms posed three problems; (1) how to extend short stub bolts, (2) how to clean our threads on the lead head so insulators would screw on easily and (3) how to center and hold the ¾-in. pin bolt in the 2-in. pin-hole of a high line arm that had been drilled for wooden pins. All three problems were solved by the exercise of a little ingenuity.

The original short pin-bolt intended for a steel tower arm was extended by welding to it a 6-in. length of ¾-in. rod. Scrap eye bolts were used for this. The extension gave the pin bolt enough length to go through a wooden arm.



INGENUITY ADAPTS steel insulator pins (salvaged from tower line) for use on wooden high line crossarms: (a) An extension on the short tower type bolt; (b) a tool for cleaning and straightening lead pin head threads and (c) a maple cob to center pin bolt in 2-in. crossarm pin hole

To clean the threads of the lead pin head, the shank of a discarded file was bent in a semi-circle and given a lead corresponding to about half the pitch of the thread on the pin, as shown. This simple tool when slipped over the lead head and run over the threads effectively cleans out dirt and straightens jammed threads.

Finally, to center the pin bolt in the 2-in. crossarm pin hole (2-in. centering washers couldn't be had) wooden cobs were made up as shown, 5 in. long, 2 in. in diameter with a ¾-in. hole bored through the center. The cobs, which were cut in two longitudinally, were boiled in paraffin to control moisture absorption. These cobs fit the pin holes closely when pin bolts are tightened and effectively center the bolt.

•

Low-Resistance Grounds Kinds and Merits

Three methods for making low-resistance ground connections and their relative merits are outlined in Bulletin 15.66 issued by the Inspection Department of Associated Mutual Fire Insurance Companies, Boston, as follows:

Water Mains—"The most reliable and permanent low resistance ground connection is an underground leaded-joint, cast-iron water main, and it should be used even though it is as far as 50 ft. or 75 ft. away. Threaded steel water pipe 3 in. in diameter or larger is equally-acceptable.

"Each down conductor should be connected to a separate length of pipe, preferably by a substantial copper or brass ground strap clamped to a space on the pipe which has been thoroughly cleaned of all corrosion and paint down to the bare metal. The strap should be drawn up tightly by at least two substantial brass or bronze bolts. The end of the down conductor should be bolted and brazed to the strap. After connections have been made, the entire assembly should be thoroughly coated with heavy asphaltum paint to prevent corrosion."

Copper Plates—"Where is is impracticable to provide grounding as described above, buried copper plates (one for each down conductor), not less than 9 sq. ft. in size, and No. 16 Stubbs gage will usually provide the next best ground if buried below permanent moisture level with about 2 ft. of crushed coke or charcoal above and below them."

Driven Rods—"A driven rod or pipe ground has been found to be the least reliable, due largely to the small area of earth contact and the influence of weather conditions upon the ground resistance.

"Rods should be either galvanized iron or copper-clad steel at least ⅝-in. in diameter and not less than 6 ft. in the ground. Galvanized iron pipe ¾-in. or larger frequently provides a better ground than rods, due to the greater surface area and because it can be driven deeper due to its greater rigidity.

"Where buried plates or driven rods or pipes are used, a test of the ground connections is especially important, and if the resistance is found to be more than 5 ohms, one additional buried plate or two additional driven rods or pipes, spaced at least 10 ft. apart, should be provided for each down-running conductor."

Three methods for testing lightning rod and arrester grounds will be presented in a subsequent issue.

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Grease Trolley Buses by Fluorescent Light

By ROY BRIDGES
Indiana Service Corp., Fort Wayne, Indiana

Fluorescent lighting for all the pits where trolley coaches are inspected and greased in the transit shops of Indiana Service Corp. Fort Wayne, rates high on the company's list of post-war shop improvements. Already one of the four pits has been lighted with fluorescent units on a temporary basis using open-type, industrial fixtures with wartime pressboard reflectors. In spite of the obvious disadvantages of using open-type luminaires in such an application, the improvement of lighting on the under side of the buses at this pit has been remarkable and has been instrumental in speeding the servicing of trolley buses to a considerable degree.

In the future when more conventional metal luminaires become available it is proposed to replace the pressboard unit with industrial units closed with unbreakable glass to reduce lamp breakage and minimize the problem of keeping reflectors clean in the presence of dropping dirt, grease and oil.

Pit in which the luminaires are installed is 4 ft. wide at the top, 4 ft. 6 in. deep and approximately 30 ft. long. Four three-lamp (40-watt) industrial units are installed about a foot from the pit floor and tilted at a 30 deg. angle from the vertical to illuminate the running gear of the trolley buses. Units are arranged in pairs on opposite sides of the pit. The pairs of units are spaced on 19-ft. 8-in. centers under the front and rear trucks of the bus.

Pit for Contactor Inspection

In addition to the greasing and inspection pit that runs beneath the bus a side inspection pit is provided about midway of its length for convenience in the inspection and repair of electrical contactors in the "switch group cabinet" at the side of the coach. At this station a two-lamp (100 watt) open-type pressboard reflector is mounted on the guard rail behind the inspector and arranged to direct light into the control cabinet as shown.

•

Home Lighting Survey Finds Sockets Empty

Anyone who doubts that the war's end will find many empty sockets in the home need only turn to the early returns of Nebraska Power Co.'s recently inaugurated lighting recommendation activity. In its first eight days seven home lighting girls in Omaha made 536 home surveys and closed 314 sales involving 370 cartons of lamps or more than seven lamps per sale with an average wattage per lamp of 71 plus. Average wattage increase in the home was 208 watts per sale.

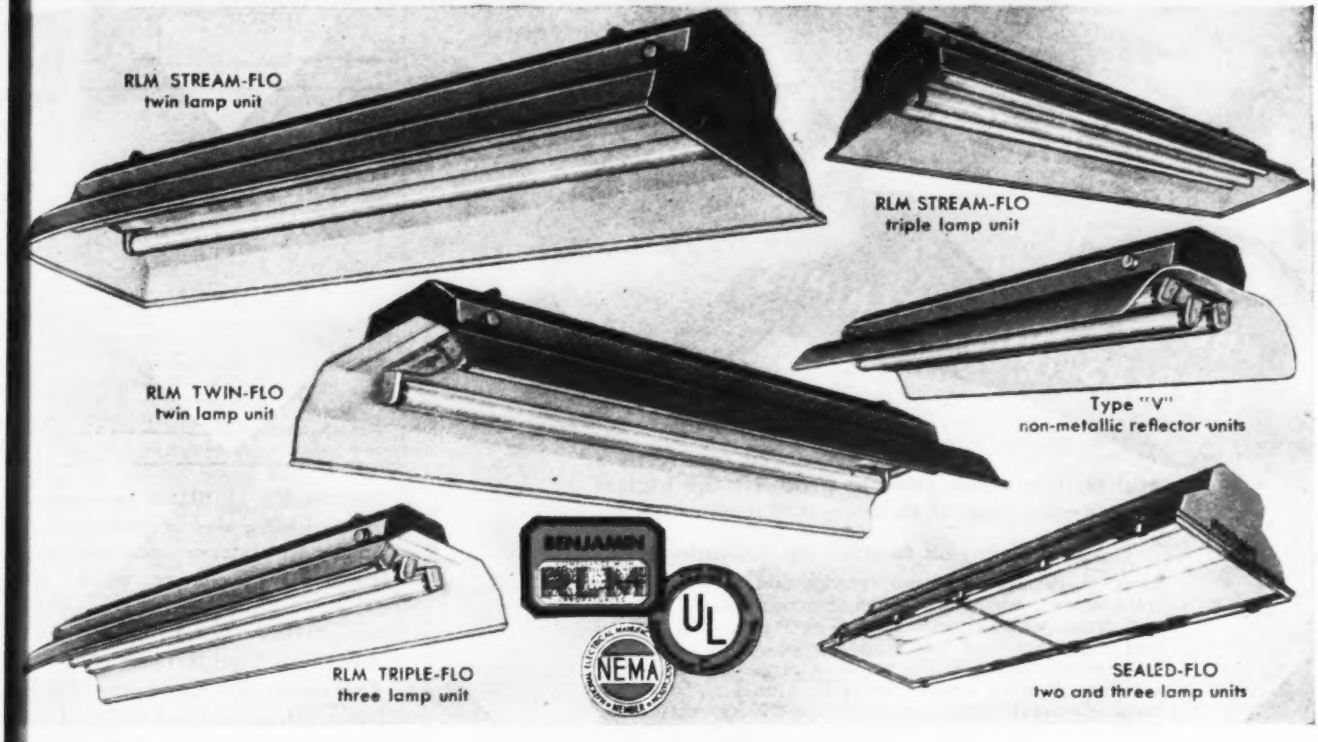
The activity as conceived has five objectives: (1) To fill empty sockets, (2) To give low-use customers the benefit of better lighting for the protection of eyesight, (3) To give customers a written recommendation showing the proper size bulb needed for various sockets throughout their homes, (4) To sell customers on the cheapness of proper lighting and (5) To increase kw.-hr. consumption among the low-use customers.

Quota that has been set for the activity is ten recommendations per advisor per day; a lamp bulb order on every other recommendation.

Plan of operation for the activity calls for a systematic canvass among

FLUORESCENT UNITS in greasing and inspection pits below and at side speed servicing of trolley buses. Beneath the bus (left) are four 3-lamp (40 w.) industrial fixtures with pressboard reflectors. Pairs of units, which face each other across the pit, are mounted at a 30-deg. angle and direct light up under the bus. Fixture pairs are 19 ft. 8 in. apart on centers. Side pit (right) for inspecting and servicing contactors in switch group cabinet is equipped with a single pressboard unit housing two 100-watt fluorescent lamps which is mounted on guard rail behind inspector

Again Available . . . Benjamin Porcelain Enamel Steel Fluorescent Units



Again obtainable*, are Fluorescent Lighting units which meet the highest specifications for efficiency, durability, long life and ease of maintenance.

For Benjamin RLM Fluorescent Lighting units with Benjamin *Life-Time porcelain enamel steel* reflectors are back in production! Now, again, you can secure the unequalled advantages of fluorescent lighting with porcelain enamel** light reflecting units.

Not only do these units bring to you the extra safety factor of strength and durability insured by Benjamin's "built-like-a-battleship" construction; *the ease of installation and maintenance* features which have long identified Benjamin with economy and lower over-all cost; but also they bring you the latest developments in trouble-free and more efficient auxiliary equipment.

**Subject to existing priority regulations.*

WRITE TODAY FOR NEW BULLETINS containing complete descriptions and data on the various Benjamin RLM Fluorescent Units now available. These include Twin and Triple-Lamp closed and open-end units for both 48" and 60" fluorescent lamps; also, the Benjamin dust-tight and vapor-tight fluorescent units and the Type "V" non-metallic reflector Fluorescents. Write Product Information Department **K**, Benjamin Electric Mfg. Co., Des Plaines, Illinois

***Experience has proven that there is no substitute for the strength, durability, high light output, diffusion and sustained lighting efficiency of porcelain enamel. It cannot decompose, oxidize or disintegrate. It is impervious to practically all atmospheric conditions obtaining in Industry. Its glass-hard surface cannot be penetrated by dirt nor grime nor worn away by repeated washings. It is the easiest of all reflecting surfaces to clean . . . soap and water quickly restoring it to its original light reflecting efficiency.*

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The plant houses hundreds of machines, some standard, some special . . . machines for heading, forging and threading huge fastenings and small . . . all engineered to do the best job on non-ferrous and stainless alloys.

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Harper maintains large stocks of a great variety of sizes and types of non-ferrous and stainless fastenings, many of which are considered "hard-to-get." The number and variety of stock items are being constantly enlarged.

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customers whose average consumption is less than 100 kw.-hr. per month, a recommendation sheet, shown, stencilled with the name and address of each such low-use customer, as indicated by the ledger sheets, are used as daily assignment sheets. Home lighting advisors work in two groups dividing the calls between them.

CUSTOMER'S LIGHTING recommendation form being used in Omaha's home lighting activity among customers using less than 100 kw.-hr. per month

Each group works from one car to conserve on transportation.

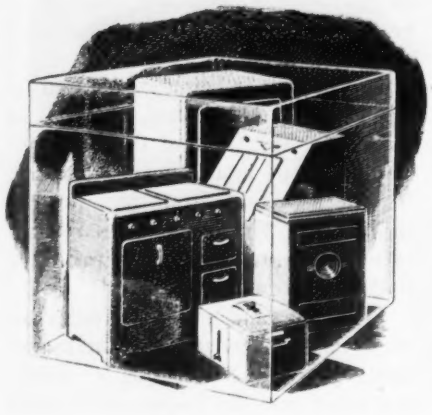
On each call the home lighting advisor follows a fixed order of business: (1) First a check is made of the customers lighting in every room in the house. (2) Condition of equipment and size of lamp bulbs in use is recorded. (3) A lighting recommendation suggesting proper size bulbs and correct placement of lighting equipment and repairs is prepared for the customer if necessary and (5) an attempt is made to get a signed order for lamp bulbs needed. Bulbs that are ordered are delivered by the advisor the second following day.

•

Hartford's "Trading Post" Speeds Up

Hartford Electric Light's appliance pool, started for customer convenience about December 1, 1943, has been doing a land office business this year. To November 24 a total of 997 electrical appliances had been listed by owners desiring to sell them, and 866 had been sold through the utility's cooperation in maintaining a list of available items for the benefit of

Synthetics
for the Electrical Future

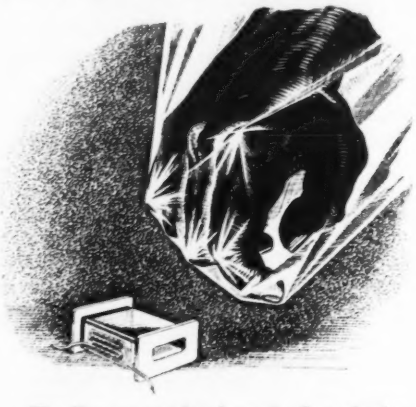


AFTER THE WAR, a great upsurge in industry, and in living, is sure to come from the electrical field. Manufacturing of all kinds will be electric-motorized as never before. The "packaged kitchen" based on a complete array of labor-saving electrical appliances, from automatic dish washer to quick-freeze cabinet, promises to revolutionize housekeeping. Television, air conditioning, radio, new electronic conveniences, can create and support wide employment.

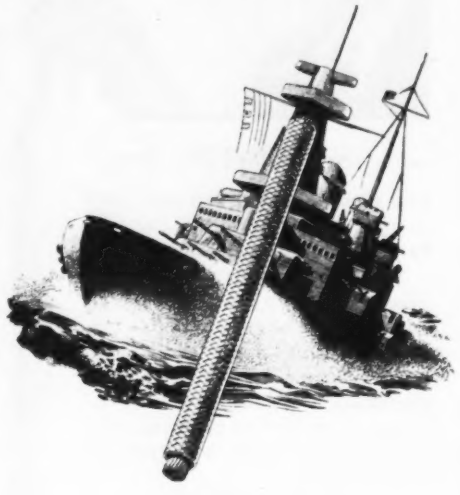
That is why every contribution that speeds the progress of the electrical industry—both as to research and new and better materials — is of basic importance to the country. And towards this end, synthetics can be counted on to play a major part because these precision materials in the form of textiles, chemicals, and plastics can be created from the ground up to supply predetermined electrical properties and advantages.

For example, the Lumarith* plastics produced by Celanese Corporation of America, include many types especially developed for insulating and controlling electrical current. Free of natural limitations, these Celanese* synthetics can combine a wide range of advantages in one material—such as high resistance to moisture, acids, and corrosion, excellent dielectric strength (insulating ability), toughness and ease of fabrication.

Lumarith insulation protects wire and coils against "The Black Hand of Corrosion," a major cause of electrical failure. Coils are a vital part of nearly all electrical equipment—from fluorescent lights to electric motors. Other forms of Lumarith are preferred for making molded electrical parts —switch boxes, housings, handles.



Textiles are another branch of synthetics that is increasingly important for electrical uses. Celanese* synthetic yarns, developed with special characteristics, are ideal for insulating wraps and for braids on wire. Celanese fabrics serve as backing for pressure-sensitive tape and fused-edge ribbon tape. In addition to high dielectric strength,



these yarns and fabrics are acid-resistant and also resistant to mildew and fungi. The latest Celanese synthetic textile with great possibilities for electrical service, is Fortisan*—the world's strongest textile yarn. Its great strength in small diameters points to wide use in tinsel cordage.

Chemicals synthetically created are also available with specific electrical advantages "built in." Lindol*, a Celanese development in organic phosphates, is non-flammable and makes possible flame-resistant electrical cable coatings for war planes and battleships.

Good insulation is fundamental in the development and growth of the electrical industry. To assist in application problems Celanese maintains field Technical Service Staffs specializing in each branch of synthetics — plastics, textiles and chemicals. Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

Celanese*

CELANESE TEXTILES

CELANESE PLASTICS

CELANESE CHEMICALS

*Reg. U. S. Pat. Off.

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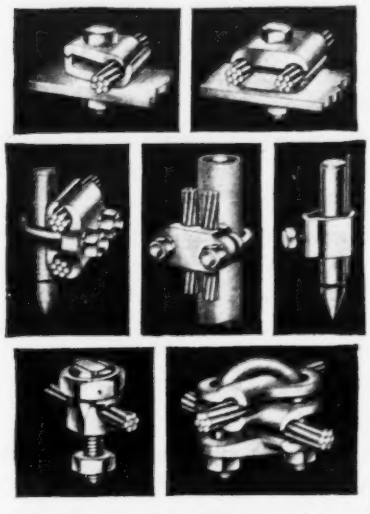
"You can get **ANY** Grounding Connector—

—in the **COMPLETE** line."

The pictures below can only give you an idea of the variety, because **Penn-Union makes ALL good types.**

Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union connectors are the choice of leading utilities, industrials, contractors and electrical manufacturers.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

would-be purchasers. As was noted in ELECTRICAL WORLD February 19, 1944, page 134, 158 appliances had been listed up to January 12, 77 having been sold. This means that 839 appliances have since been listed and 789 sold.

Forty-seven kinds of appliances have been listed since operations began. The demand for fans, irons, mixers, ranges, refrigerators, space heaters, sun lamps, table stoves, toasters, vacuum cleaners, waffle irons, washers and water heaters has been so heavy that virtually none remain unsold. Thus, 345 out of 346 irons, 15 out of 16 mixers, all 18 fans, all 4 hair driers and all 3 infra-red lamps, 8 out of 9 portable ovens, 145 out of 156 ranges, all 25 refrigerators, all 17 space heaters, 29 out of 31 table stoves, 41 out of 44 toasters, 34 out of 38 vacuum cleaners, 25 out of 29 waffle irons, all 22 washing machines and 8 out of 9 water heaters were sold.

Relatively slow moving devices included clocks, egg cookers, hair curlers, small motors, and several other small outfits. Since most of the listed appliances are of the used category, their condition unquestionably affects their sale; so that far-reaching conclusions should not be drawn as to the relative popularity of new equipment suitably promoted and merchandised from the above data. The weight of demand for heavier and labor saving devices, is however, quite apparent.

•

To Evaluate Farm Uses of Electricity

An Ohio farmer has started electrification of his 160-acre dairy farm in a fact-finding project to determine what can be saved in time, money and labor and what increases in production he can get through the use of electricity.

The project is being sponsored by the Westinghouse Electric & Manufacturing Co. which hopes to obtain a detailed cost and production picture of the use of electricity on a small farm. Although aided by Westinghouse, Joseph Motz, the farmer, is paying all power and equipment costs out of his income.

To set up a basis of comparison between farm work on a non-electric and an electric serviced farm, time and motion studies have been and are being made of all farm work done before the application of electricity and after. They are being done by Norman G. Wagy, of the Ohio Public Service Co., and are believed to be the first studies of this type ever made of a farmer's work.

The project is being supervised by the Doane Agricultural Service, of St. Louis, Mo., one of the country's leading farm management concerns. It will ascertain from Mr. Wagy's studies and Mr. Motz' farm records to what extent electricity is of value to the small farmer.

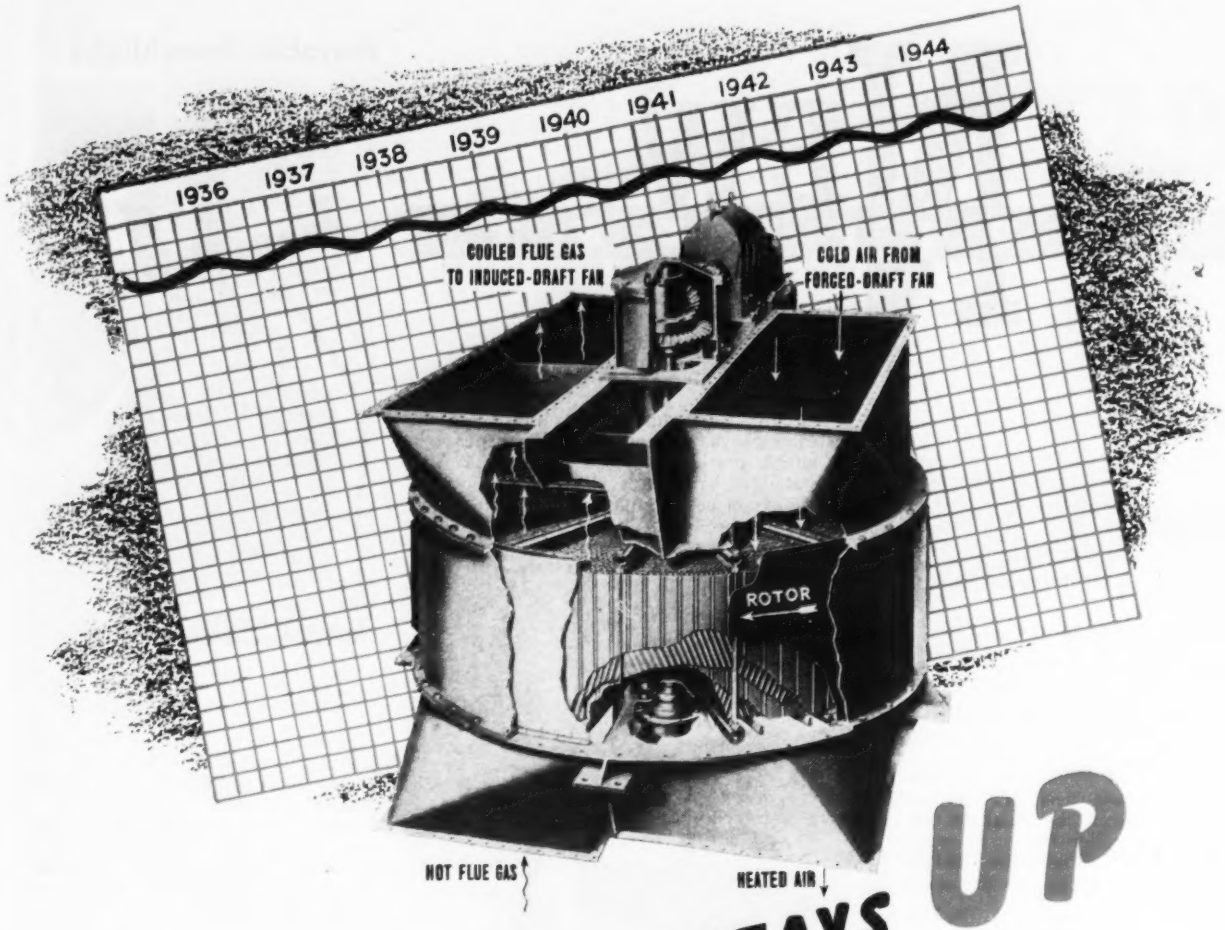
The time and motion studies already made show that the family annually carried 10.76 tons of drinking water into the house and covered a distance of 49.21 miles to accomplish this task.

Water for the dairy cattle, the studies indicated, involved carrying 604.8 tons of water and took 350 man-hours during the five-month period the cattle are watered in the barn. When an electric deep well pump is installed, Mr. Motz will save the equivalent of 35 working days and without carrying a drop.

Saves Time and Money

The use of a one-third electric motor is saving Mr. Motz time and money, according to the Doane report, submitted to W. D. Hemker, manager of the Westinghouse Rural Electrification Division. The report shows that sharpening of a mower-sickle on the farm saves him 18 hours during the cutting season plus $7.96, his cost for taking the mower-sickle to a blacksmith. "Mr. Motz did not expect his power to pay its own way until he installed major productive electric equipment, such as the deep well pump, but it has made an operating profit during the first two months in use," Mr. Hemker said.

The Westinghouse manager cited a total profit of $17.57 by doing farm tasks with electricity, which, after the electrical bill of $10.92 was paid, left a net profit of $6.65. "This profit was based on a maximum rate consumption of power and does not reflect the profit that could be obtained when the farm gets the benefits of lower rates through increased use of current." The Doane agency figured the profit through the use of electricity partly by crediting wages to the Motz farm for the time saved through the use of power.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COOLED FLUE GAS TO INDUCED-DRAFT FAN
COLD AIR FROM FORCED-DRAFT FAN
ROTOR
HOT FLUE GAS
HEATED AIR

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So long as it is still necessary to use subnormal fuels, operating conditions will continue to be radically different from those for which steam generating plants were designed. With the Ljungstrom, continuous full-heat recovery has been made possible, in spite of abnormal conditions, as a part of the Air Preheater Corporation's service to you.

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ENGINEERING SERVICE — The engineering staff also is prepared to assist you in applying standard or special types of Ljungstrom preheaters to steam generating units, oil refinery heaters, metallurgical furnaces, etc., or to help you and your engineers make better use of low-grade, more abundant fuels.

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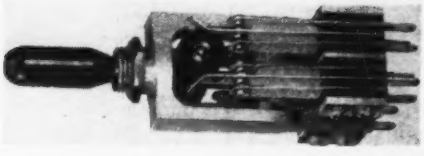
NEW EQUIPMENT

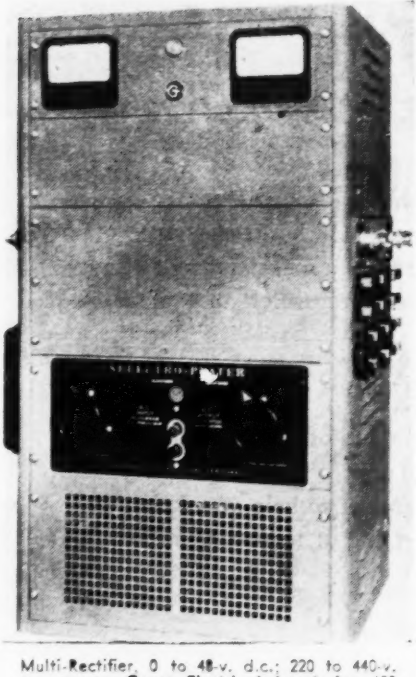
Switch



Model MCM; 125-v. a.c.; cap., 5 to 10 amp.; size, 2¾-in. long by 1¼-in. wide by 1¼-in. thick; wt., 3½ oz.; **General Control Co.**, 1200 Soldiers Field Rd., Boston 34, Mass.

All parts of the cam lever switch, which was designed for aircraft and other light duty applications, are reported to be non-corrosive. It is available with either three positions or two positions (no neutral). Switch is said to be balanced providing easy positive roller action, to require but a single hole for mounting and to have locking key which prevents the switch from turning.

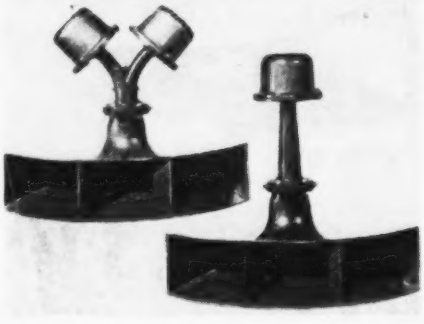
Rectifier



Multi-Rectifier, 0 to 48-v. d.c.; 220 to 440-v. a.c. source; **Green Electric Laboratories**, 130 Cedar St., New York 6, N. Y.

Incorporates six selenium rectifier sections which may be interconnected by external links to provide four ranges of d.c. power; 0-8 volts, 100 amp. max. capacity, 0-16 volts, 50 amp., 0-24 volts, 35 amp., and 0-48 volts, 18 amp. Has built-in voltmeter and ammeter connected to output circuit. Maximum current limitations for each range are indicated. Wing nut terminals provided for load connections. Also stated to have three phase magnetic contactors in power supply circuit with on-off pushbutton, pilot lamp, monitor lamp, overload warning, and provision for automatic current interruption in case of prolonged overloads.

Loudspeaker



Type 26-B loudspeaker; cast aluminum; power input 40 watts when equipped with two Jensen U-20 drive units; 22-in. wide by 14½-in. deep by 20-in. high; **Langevin Co.**, 37 W. 65th St., New York 23, N. Y.

Loudspeaker designed to operate in high noise levels. It is said to provide uniform distribution over horizontal angles of 120 deg. and vertical angles of 40 deg. The unit is cast aluminum, equipped with heavy universal mounting brackets and is reported to be designed for economy of installation.

Terminal Block

Bee terminal block; laminated phenolic base; **L. S. Brach Mfg. Corp.**, Newark 4, N. J.

Block is a connector strip with any desired number of terminal parts set in either a straight line (series A-300) or stagger (series A-200). Binding post stud has a slotted channel. The wires are held in this channel between a top clamp or shoe built into the nut, and a lower clamp or shoe which is secured to the base. Test results said to show average contact resistance of 0.00031 ohms after 90 hours salt spray.

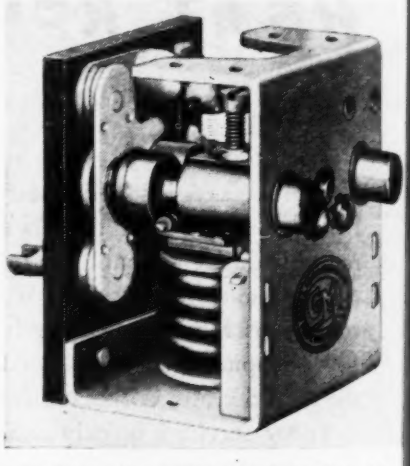
BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Portable Searchlight

"Big Beam" No. 411 portable electric hand searchlight; 6-v. storage battery; beam or flood; **U-C Lite Mfg. Co.**, Chicago 11, Ill.

Searchlight which, it is stated, will project a 2500-ft. beam or by means of a snap-on lens, will spread the same amount light over a wide area. Powered by 6-v. storage battery which is rechargeable without removing from case. Swiveled lamp head. May be carried by hand or with shoulder strap. By use of a hold-down can be anchored to any flat surface.

Circuit Breaker



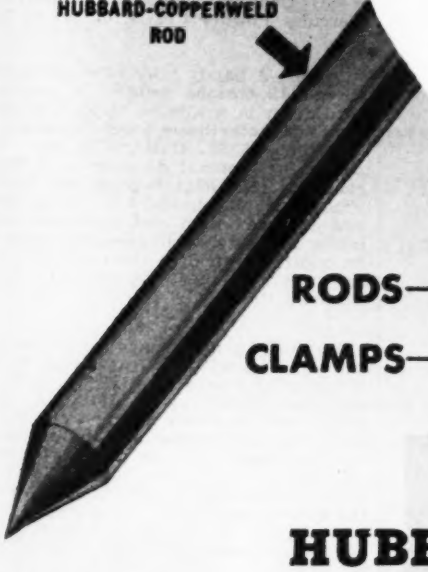
Multiple coil overload circuit breaker; a.c. or d.c.; 70 amp. max. interrupting capacity; arc gap totals 3/16 in.; wt. 9 oz.; **G-M Laboratories, Inc.**, 4300 N. Knox Ave., Chicago 41, Ill.

Circuit breakers designed for either a.c. or d.c. use are available with as many as three separate coils in series with the contacts. These coils may vary in number of turns and wire size so that protection against overloads of three widely separated values, from a fraction of an ampere to 70 amp. maximum, is said to be obtained. Each winding has an independent terminal and the current at which the circuit breaker operates is dependent upon the terminal to which the load is connected. Recommended for use with power vibrators or other electronic equipment.

HUBBARD-COPPERWELD

GROUND RODS AND CLAMPS

Grounding Wire
Safety Screw
No. 9492 Clamp
Five safety screw wrenches are furnished with every 100 clamps
Square Head Bolt
5/8" Diam. Hubbard Copperweld Ground Rod
No. 9592 Clamp



CROSS-SECTION OF A HUBBARD-COPPERWELD GROUND ROD SHOWING APPROXIMATE PROPORTION OF COPPER AND STEEL WHICH IS MAINTAINED IN ALL DIAMETERS OF ROD.

RODS—DIAMETERS FROM 3/8" TO 1"—LENGTHS FROM 5 FT. TO 40 FT.

CLAMPS—TWO STYLES, SAFETY SET SCREW AND SQUARE HEAD BOLT—FOR ALL DIAMETERS OF RODS.

HUBBARD AND COMPANY

EXCLUSIVE NATIONAL SALES AGENT FOR
COPPERWELD GROUND RODS AND CLAMPS

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

1 The coil in a perfectly flat plane is welded to a new type unit support thus assuring maximum utensil contact area.

2 All edges are rounded . . . this means no more scratched hands.

3 The coil raises to a wide angle and the pan is removable making it very easy to clean.

4 The heating coil assembly may be replaced separately—without replacing entire unit.

Women will want TK UNITS on their new electric ranges for 4 "new" reasons

These new features added to all the well-known dependable TK qualities are real box-office attractions.

TK BETTER ELECTRIC RANGE UNITS

*TK **REPLACEMENT UNITS** are **NOW** available. Send for new free Replacement and Service Manual No. 8.*

TUTTLE & KIFT INC.

GENERAL OFFICES AND PLANT

1825 NORTH MONITOR AVENUE · CHICAGO 39, ILLINOIS

Makers of Electric Heating and Cooking Devices

TECHNICAL LITERATURE

Welding Cast Iron—A 12-page illustrated booklet entitled "4 Ways to Salvage, Reclaim and Conserve Iron Castings by Electric Arc Welding" is obtainable upon request from C. E. Phillips & Co., 2750 Poplar St., Detroit 8, Mich. Contains a discussion on the difficulties encountered in arc welding cast iron, points out that no single welding material or procedure can be recommended as a universal practice. Electrodes for this type of application are described, and the characteristics and welding procedures for each are explained. Micro-photographs of the deposits made by the electrodes are used to show the penetration, the grain structure at the fusion zone and grain structure of the deposit.

Polyethylene Resins—For this group of thermoplastic materials, one of the applications being ultra high-frequency wire and cable, tabulated values of electrical and mechanical properties, thermal expansion, and plasticity, also a description of the fabrication procedures and uses are presented in a 12-page booklet, entitled "Polyethylene Resins," available from Bakelite Corp., 30 East 42nd St., New York 17, N. Y.

Deaerating Feed Tanks — Elliot Co., Jeannette, Pa., offers a 30-page handbook plus charts and table. It is called "Deaerating Feed Tank Instruction Manual NH-500." It deals with the purpose of deaerating feedwater heaters, and contains a description of their construction and operation. General maintenance suggestions are also included. The book is designed to give an operator a general idea of the extent of any deaerating feed tank repair job before undertaking it.

Cellulose—A 48-page booklet listing and describing the properties of ethyl cellulose. By the use of tables and graphs the properties of flammability, discoloration by sunlight, heat resistance, solubility in cheap solvents, toughening and hardening action in compositions in which it is soluble, flexibility of compounds at low temperatures, assistance in elimination of surface tack and usefulness in the formation of both rigid and soft plastics are made known. Copies may be secured from Cellulose Products Department, Hercules Powder Co., Wilmington, Del.

Table—A handy table of machine screw thread dimensions printed in pocket-size card form is available from Engineering Dept., Manufacturers Screw Products, 222 W. Hubbard St., Chicago 10, Ill. Table shows the nominal diameter and threads per inch (National Coarse and National Fine) for all standard machine screws and the maximum and minimum major, minor and pitch diameters for each size. In addition, tap drill sizes and diameters for each screw are also given, as well as a handy rule.

Blends—An eight page technical bulletin (PM 4) entitled "Geon-Hycar Blends" released by Chemical Division of The B. F. Goodrich Co., Rose Building, Cleveland, Ohio, is available upon request. It lists the advantages and limitations of the "marriage" of Geon resins with Hycar oil resistant synthetic rubbers, and discusses compounding techniques, as well as the mixing operations. Data on the curing and physical properties of typical formulations are covered in four pages.

Lifting Magnets—Kind of material to be lifted, lifting capacities of various sizes of magnets and their operating data are tabulated in Bulletin 35A issued by Stearns Magnetic Mfg. Co., Milwaukee 4, Wis.

HAVE YOU GOT THOSE *Inventory Blues?*

Because if you have, here's a cure.

Let your nearby T&B stocking Distributor carry your inventory for you. Empower him to watch and anticipate your requirements and bring you what you want when you want it.

Here are some of the *annually recurring* savings you can figure on:

Storage space. Rent, light, heat, up-keep, repairs, etc. $.....
Insurance and Taxes . . . .
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Handling costs . . . .
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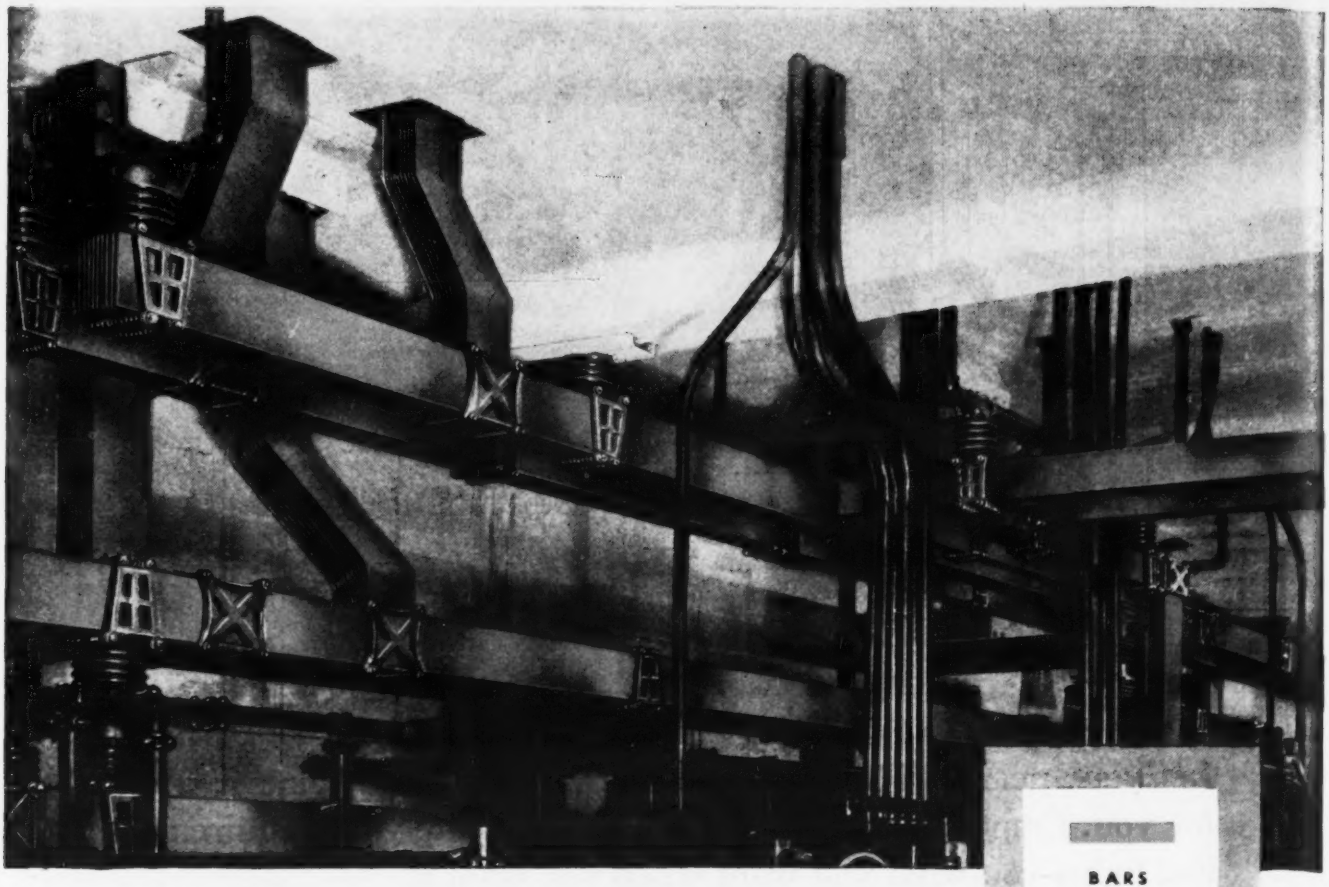
Not to mention FEWER salesmen to interview—orders to write—incoming shipments to handle—invoices to check—delays on catalog and price information—credit delays.

All this and Service too, when you let your Electrical Wholesaler carry your inventory for you.

We at Thomas & Betts recognize that Wholesaler Distribution of electrical products is the only economically sound way. We therefore sell all T&B products exclusively through the competent service organizations of T&B Distributors.

T&B

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1899
ELIZABETH, N. J., NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal



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MORE EFFICIENT POWER TRANSMISSION WITH ANACONDA BUS SHAPES

WHEREVER modern electrical engineering practice requires bus construction embodying structural strength, low ohmic and reactance losses or effective heat dissipation, the range of copper bus shapes made by The American Brass Company will meet every specification.

BARS—Require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES—Provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

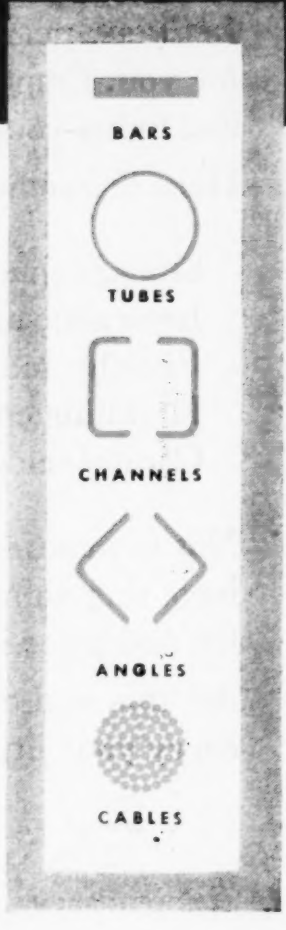
CHANNELS—Have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES—Are ventilated hollow busses with highest rate of heat dissipation, handle greater current density but require more space for installation.

CABLES—Solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces.

4921J

Write for Bus Conductor Booklet C-25, or consult The American Brass Company Technical Department.



ANACONDA

BUY MORE WAR BONDS

Anaconda Copper

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Co. • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

NEWS ABOUT PEOPLE

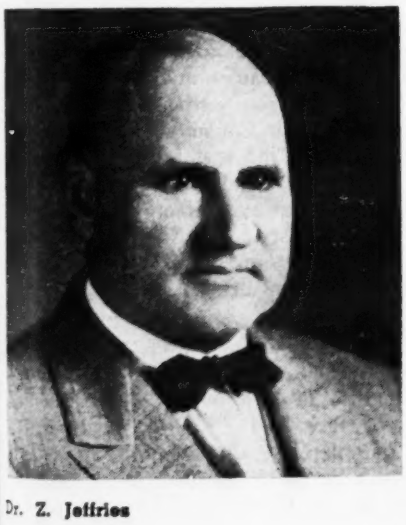
General Electric Elects New Vice-Presidents

Establishment of a new chemical department and appointment of three new vice-presidents have been announced by Charles E. Wilson, president of General Electric Co.

Dr. Zay Jeffries, technical director of the company's lamp department, will be general manager of the new chemical department and becomes a vice-president. The other new vice-presidents are M. L. Sloan, who will become general manager of the lamp department, succeeding J. E. Kewley, who is being relieved of his duties at his own request, and R. H. Luebbe, who becomes general counsel of the company.

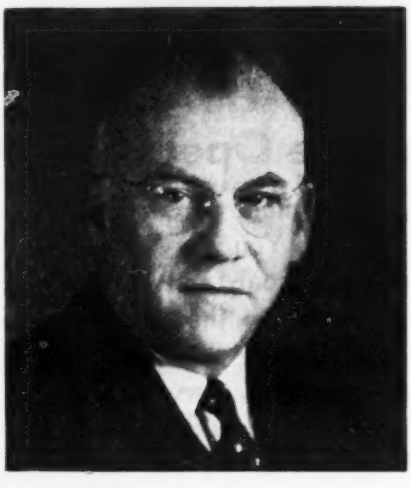
The chemical department will be established as of January 1, Mr. Wilson said, and will assume responsibility for all operations pertaining to plastics, resins and insulation materials.

Dr. Jeffries has been associated with General Electric since 1914. Last year he was the first recipient of the Gold Medal of the American Society for Metals awarded "in recognition of his outstanding metallurgical knowledge and his great versatility in the application of science to the metal industry." In addition to this award the Society's Albert Sauveur Medal and the James Douglas Medal of the American Institute of Mining and Metallurgical Engineers have been awarded to Dr. Jeffries. He is a member of numerous technical societies and as a lecturer is widely known in this country and abroad.



Dr. Z. Jeffries

Mr. Sloan's first position was with the old General Electric National Lamp Works in Cleveland where he was employed as commercial engineer. In 1912 he was transferred to the Youngstown (Ohio) lamp works where, in only a few months, he was advanced to the position of assistant manager. Since his transfer in 1913 to the Nela Park headquarters, he has served in the manufacturing department, as assistant general manager of manufacturing, manager of the lamp manufacturing department, in the administration department, assistant manager of the lamp department and as manager of the lamp department.



M. L. Sloan

Mr. Luebbe has been with the company since 1928 and was serving as assistant manager of the appliance and merchandising department at Bridgeport at the time of his recent promotion.

•

▶ WALTER H. SAMMIS, president of the Ohio Edison Co., Akron, was elected a director of the Ohio Chamber of Commerce at the annual meeting held recently in Cleveland.

▶ C. P. CHRISTENSEN, formerly engineer in charge of installation of electrical units in the Grand Coulee dam powerhouse and supervisor of powerhouse operators, recently was promoted to director of power at Boulder Dam.

Dr. Hobson New Director of Armour Research

Dr. Jesse E. Hobson has been appointed director of the Armour Research Foundation of Illinois Institute of Technology to replace Harold A. Vagtborg, who has been named president of the Midwest Research Institute in Kansas City. Mr. Vagtborg will report to his new position on January 1.

Dr. Hobson has been head of the electrical engineering department at Illinois Tech since 1941. His appointment coincides with increased emphasis on electrical research which is being contemplated by the Foundation with a new division of electrical engineering at present being activated.

In 1940, at the age of 29, Dr. Hobson was voted the outstanding young electrical engineer of the nation by Eta Kappa Nu, national honorary fraternity. It was he who recently arranged with 16 electrical manufacturing and electric utility companies of the Chicago area for the installation of a network calculator at Illinois Tech.

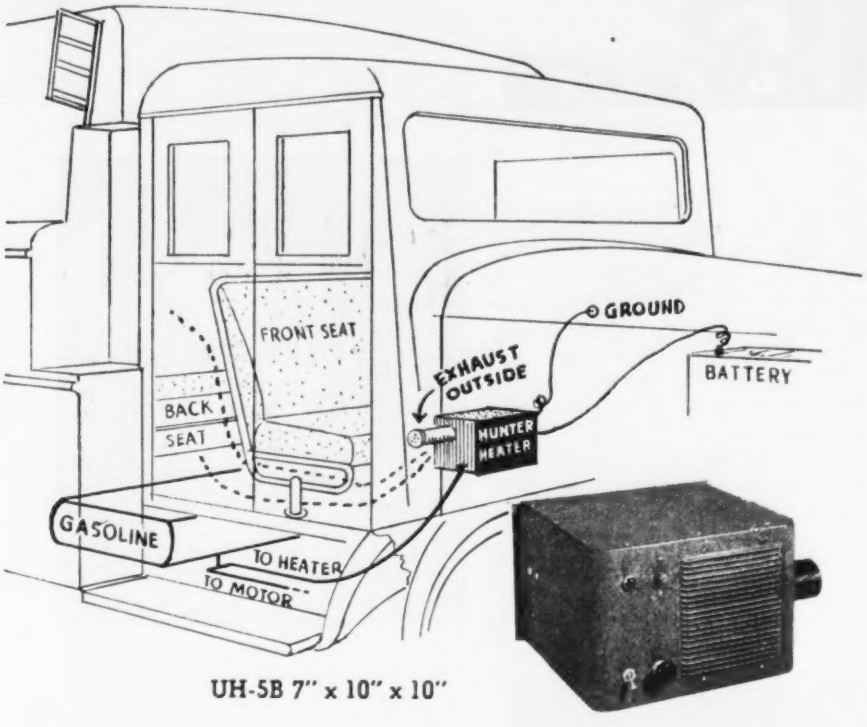
He has had a wide industrial experience in addition to his academic work. From 1937 to 1941, he served in the engineering department of Westinghouse. During that time, as central station engineer for the Northwest district, he was in charge of the consulting service provided for customers' engineers.

He was the executive chairman of the National Electronics Conference held in Chicago this fall and has served as a member and chairman of a number of A.I.E.E. committees. During his stay at Illinois Tech, Mr. Hobson has been a consulting engineer for the United States Government and various organizations.

•

▶ D. E. CREPS, formerly in charge of market research for the Cleveland Electric Illuminating Co., has organized the Croeps Industrial Service with

CONSTANT DEPENDABLE PERSONNEL COMFORT



UH-5B 7" x 10" x 10"

HUNTER GASOLINE CAB HEATERS Are Independent Of Engine Operation

• A Hunter Heater connects directly to the main tank, pumps its own fuel with a built-in Autopulse pump. You can see by the schematic drawing of a typical personnel cab above that installation is simple. Four bolts, a connection to the gasoline tank, wires to the battery and ground, a hole for the exhaust. Blower will not overload a good generator and battery set-up, can even be operated when engine is cut off, providing comfort for line crew when on the job as well as on the haul. Combustion is "Sealed-in-steel", exhausts to outside of vehicle. Heat volume can be regulated.

Write now for full information.

BULLETIN HG-4 Describes all types of Hunter Heaters

HUNTER AND COMPANY

Transport Equipment

CLEVELAND • OHIO

1558 EAST SEVENTEENTH STREET

headquarters in the Union Building, Cleveland. The organization will represent manufacturers of electrical products and a line of industrial chemicals. A graduate of Purdue University, Mr. Creps was a member of the Cleveland Electric Illuminating industrial sales engineering staff for 17 years.

•

New England Power Makes Executive Appointments

Thomas G. Dignan, formerly president of the Worcester County Electric Co., Worcester, Mass., and later president of the New England Power Service Co., Boston, has been elected president of the Malden (Mass.) Electric and Malden & Melrose Gas Light companies. Edwin A. Dow, vice-president and chief engineer, succeeds Mr. Dignan as president of the Service company, continuing as chief engineer with headquarters at Boston. Arthur E. LaCroix has been appointed executive vice-president of the Service company.

•

New Officers Elected by Brazilian Traction

Col. Walter Gow, of Toronto, was elected chairman of the board of the Brazilian Traction, Light & Power Co., Ltd. at a recent meeting of the board of directors. A. W. K. Billings, of Rio de Janeiro, was elected president in succession to the late Herbert Couzens and G. Howard Ferguson, Toronto, was elected a vice-president.

Colonel Gow, who was a vice-president of Brazilian Traction preceding his present election as chairman of the board, is also of the law firm of Blake, Anglin, Osler and Cassels, Toronto. He is a director of the Canadian Bank of Commerce, besides Brazilian Traction. He holds the rank of Colonel through service in World War I.

Mr. Billings, the new president, has been a vice-president and a director of Brazilian Traction and its operating subsidiary companies in Brazil.

Mr. Ferguson, who served as Canadian High Commissioner in London, 1930-35, and is a former Premier of Ontario, is president of the Crown Life Insurance Co., a director of Toronto General Trusts, Brazilian Traction, Western Assurance Co. and British American Assurance Co.

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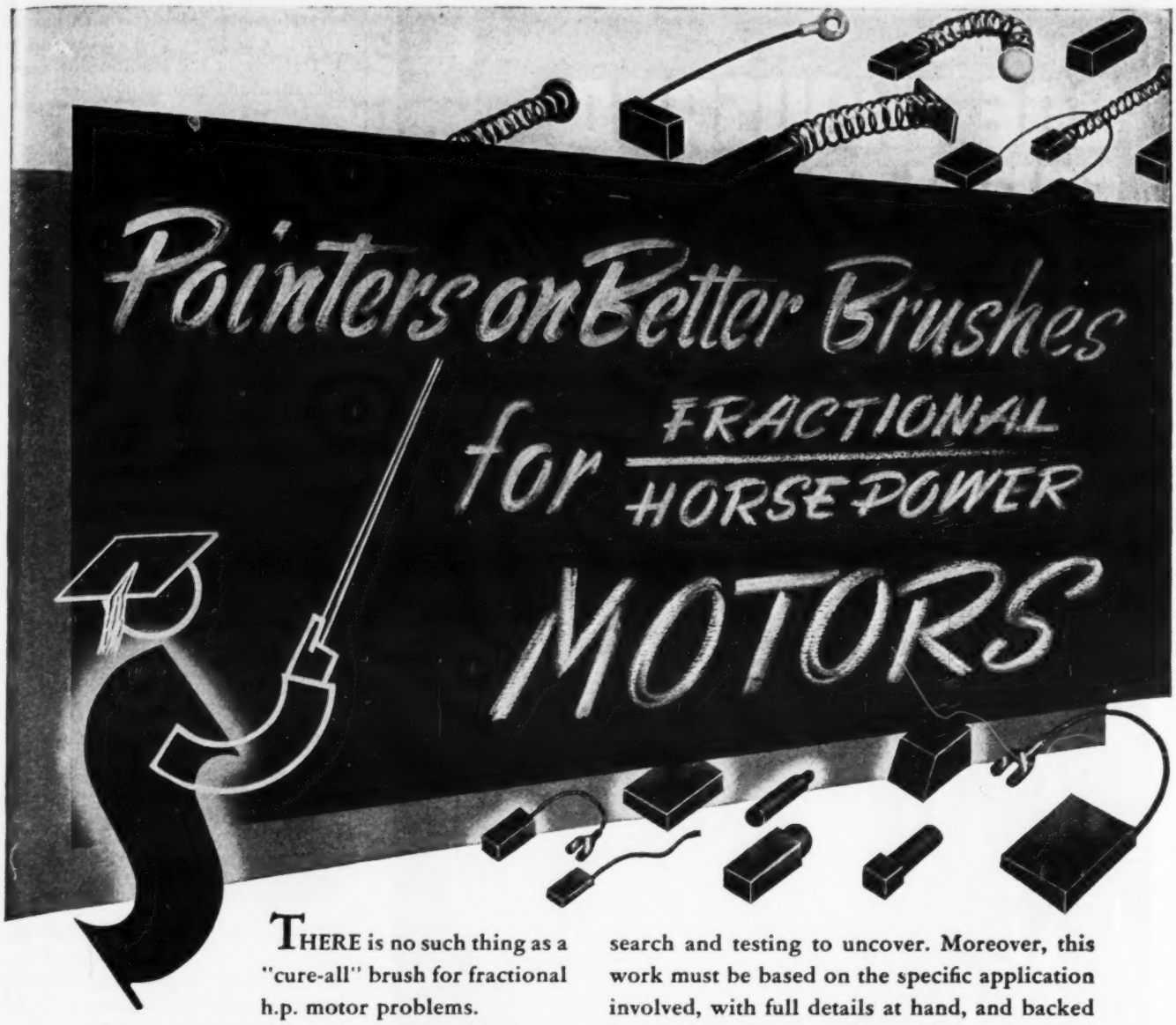
► HERMAN G. HORSTMAN has been named to head a newly created personnel office for the Public Service Co. of Indiana, Inc., Indianapolis, according to a recent announcement by President R. A. Gallagher. For the past



THERE is no such thing as a "cure-all" brush for fractional h.p. motor problems.

That's the big point about small, universal-motor problems in general. They're as alike as peas in a pod—*which means they're not alike at all.* They only seem alike superficially, and that's why brush problems begin to pile up.

This becomes more understandable when it is realized that a brush which works best on one make of, say, vacuum cleaner, probably won't work best on another. There are too many points of difference requiring painstaking research and testing to uncover. Moreover, this work must be based on the specific application involved, with full details at hand, and backed by a COMPLETE line of brush types permitting adaptations to any one of hundreds of widely varying conditions that may be indicated.

Stackpole's facilities in this direction are entirely adequate, our record of achievement in solving small-motor brush problems is unsurpassed.

We'll gladly place these facilities at your disposal in meeting either present or post-war brush requirements.

STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.

STACKPOLE

ELECTRICAL BRUSHES AND CONTACTS (*All carbon, graphite, metal, and composition types*) • RARE METAL CONTACTS • WELDING RODS, ELECTRODES, AND PLATES • BRAZING BLOCKS • RHEOSTAT PLATES AND DISCS • PACKING, PISTON, AND SEAL RINGS • CARBON REGULATOR DISCS • SINTERED IRON COMPONENTS • CARBON PIPE, ETC.

ONE THOUSAND CANDLES
IN ONE LAMP
SLATER 10,000 LUMENS
High illuminating power is built into every SLATER street lighting lamp. For example, a SLATER 10,000 lumen lamp steadily reflects the brilliancy of 1000 candlepower . . . all this light intensity incorporated into a carefully designed and precisely manufactured filament. Exacting manufacture backed by thorough engineering is a guarantee of quality illumination with SLATER street lighting lamps.
Catalog upon request.
SLATER ELECTRIC & MFG. CO.
MANUFACTURERS OF STREET LIGHTING LAMPS AND ELECTRONIC TUBES
BROOKLYN, NEW YORK

several months, Mr. Horstman has been acting as assistant to Vice-President G. J. Oglebay in the handling of general operation and management problems.

•

J. M. Trotter Promoted by Royal Electric Co.

James M. Trotter has been appointed vice-president and chief engineer of the Royal Electric Manufacturing Co., Chicago. Mr. Trotter was formerly identified with the Fisher Body Division of General Motors Corp. as an electrical engineer in their military aircraft program.

Following graduation from the University of Notre Dame in 1932, Mr.

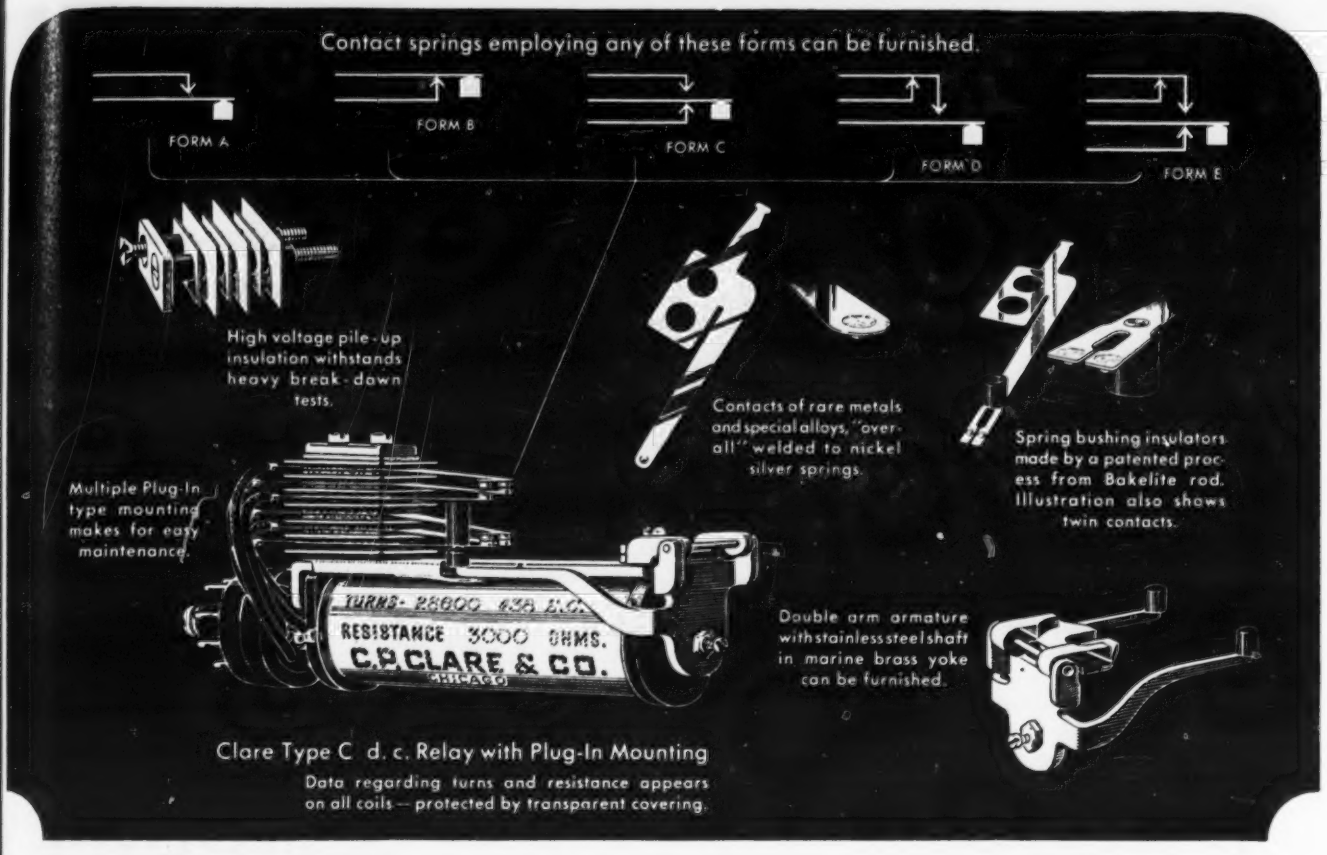
Trotter spent four and one half years with the Great Lakes Dredge & Dock Co. as electrician and chief electrician on marine construction projects. In 1937 he joined the Commonwealth & Southern Corp. in Jackson, Mich. His responsibilities included design of substations; layouts, estimates and specifications of related equipment.

It was in 1943 that Mr. Trotter became identified with General Motors.

•

► JOHN M. TURNBULL of the engineering staff of the Western Massachusetts Electric Co., Springfield, Mass., has been appointed power consultant for that utility, in connection with power sales activities.

► WILLIAM C. FITTS, JR., general counsel of the Tennessee Valley Authority, has resigned to enter private practice of law at Knoxville. From 1934 to 1939 Mr. Fitts acted as principal assistant to the general counsel, James L. Fly, in the conduct of TVA's legal business. In that capacity he participated in the preparation and trial of all of the early litigation establishing the constitutionality of the TVA. JOSEPH C. SWIDLER has been appointed to succeed Mr. Fitts


Contact springs employing any of these forms can be furnished.
FORM A
FORM B
FORM C
FORM D
FORM E
High voltage pile-up insulation withstands heavy break-down tests.
Contacts of rare metals and special alloys, "overall" welded to nickel silver springs.
Spring bushing insulators made by a patented process from Bakelite rod. Illustration also shows twin contacts.
Multiple Plug-In type mounting makes for easy maintenance.
RESISTANCE 3000 OHMS.
C.P.CLARE & CO.
Double arm armature with stainless steel shaft in marine brass yoke can be furnished.
Clare Type C d. c. Relay with Plug-In Mounting
Data regarding turns and resistance appears on all coils — protected by transparent covering.

Clare Type "C" Relays For Pilot and Supervisory Systems

A wide range of utility applications are filled by the Clare Type "C" Relay. This simple, rugged, multiple contact relay is first choice for spots where hard service, long life and absolute dependability are of prime consideration.

The Clare Type "C" Relay is especially valuable for use in operating control panels, supervisory control boards and load dispatching centers where signals are indicated from remotely located switches, circuit breakers, network protectors and other equipment.

Innumerable contact arrangements are possible with the Clare Type "C". Its standard spring assemblies may be equipped with any combination of the forms shown above. Twelve different standard, or other special, types and sizes of contacts may be provided.

The Clare Type "C" Relay may be "custom-built" to meet the exact requirements of the application for which they are required. Proper mountings are available for every application. Let our engineers know your specific relay problem. Catalog and data book will be sent on request. C. P. Clare & Co., 4719 Sunnyside Ave., Chicago (30), Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

Features of Clare Type "C" Relay

1. Contacts are made from precious metals and alloys, such as silver, palladium, palladium-irridium, tungsten and elkonium. They can be furnished in sizes from .062" silver, rated at 1 ampere, 50 watts, to .1875" tungsten, rated at 4 amperes, 500 watts. Various types can be incorporated in one relay.

2. Pile-up assembly is locked together under hydraulic pressure. Projecting wafer insulators which provide creepage path of ¼" between contact springs can be furnished. The entire assembly withstands very heavy breakdown tests.

3. Heelpiece, coil core and armature assembly are of magnetic metal, carefully annealed. Where sensitivity and timing are important factors, a *special magnetic* metal is recommended to provide permeability.

4. Spring bushing insulators of Bakelite rod give excellent service where heavy contact pressures are employed, where vibration exists, or heavy duty service is desired.

5. Coils are carefully wound to exact turns on precision machines. Lead out wires are securely soldered. Coils impregnated with special varnish are available. The coil is protected with a transparent acetate covering.

6. Relay illustrated is arranged for octal base plug mounting which makes for easy service and replacement. Other types of mounting, such as individual angle bracket, strip or panel can be furnished. Easy to handle slip-on Bakelite covers for individual mounting or metal covers for group mounting can be supplied.

C L A R E R E L A Y S

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

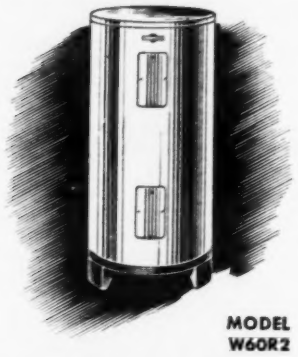
Your Best Bet
FOR
POSTWAR
LOAD BUILDING

Tomorrow's greatest potential load builder is the electric water heater. Recent market studies place the postwar demand at more than one million units!

Public utilities will find Electromaster Water Heaters of real assistance in domestic load building. Electromaster Water Heaters offer a top-quality, low-cost product with established consumer acceptance. Electromaster Water Heaters provide a dependable, service-free addition to your load building program.

In making your postwar plans, consult Electromaster —specialist in electric water heaters and ranges.

Electromaster
WATER HEATERS



MODEL W60R2

are equipped with built-in heat trap and free-flushing drain valve. Automatic thermostat maintains water temperature at any point between 130° and 190° F. Insulation is a thick layer of mineral wool. Three popular sizes are planned for early production.

ELECTROMASTER INC.
1811 E. ATWATER
DETROIT 31, MICHIGAN

as general counsel and THOMAS J. GRIFFIN has been appointed to Mr. Swidler's previous position of solicitor. Mr. Swidler is now serving in the U. S. Navy and the duties of the general counsel's position will be performed by Mr. Griffin.

•

Federal Electric Makes New Sales Assignments

A new sales manager for the Federal Brilliant Co. of St. Louis, Mo., and three new branch managers have been appointed by Federal Electric Co., Inc., Chicago.

Ray Becker, recently in charge of Federal electrical advertising sales in the Chicago district, has already taken his new position as sales manager of the Federal Brilliant Co.

New Federal branch manager at Cincinnati is Orville F. Allen, who has been identified with Federal Electric for the past 20 years and until recently was head of the personnel and traffic department at Chicago.

At Indianapolis, Earl J. Michaels takes charge as branch manager after 26 years with Federal. F. E. Cody for 19 years with Federal, leaves his position as branch manager at Indianapolis to assume charge of the Federal Electric branch at Milwaukee, Wis.

•

▶ HOMER A. KERBY, engineer with the Fort Wayne, Ind., city utilities since 1938, has been named acting chief engineer, succeeding W. T. Kehoe, who has become a co-partner with Edward J. Schaefer in a new firm, Franklin Electric Co., Bluffton, Ind. PAUL V. KRYDER has been placed in charge of all substations and industrial installations.

▶ ROSCOE P. FREEMAN of Franklin, Ind., deputy examiner for the state board of accounts, has been appointed a member of the Indiana Public Service Commission, to fill the vacancy created by the resignation of George M. Barnard. Mr. Barnard has been named to the Interstate Commerce Commission.

▶ CARL R. TURNER, power sales engineer of the United Illuminating Co., Bridgeport, Conn., has been elected chairman of the Western New England Chapter, International Association of Electrical Inspectors.

▶ J. E. BRISTER has been appointed manager of the Vinylite wire and cable compounds division of the Bakelite Corp., unit of Union Carbide & Carbon Corp., with headquarters in New York. This division will handle the servicing

SOLID SHANK
The Strongest Known Spoon

● Solid shank construction, originated by True Temper, is universally acclaimed by all important shovel users—railroads, mills, mines—as first in service life, utility and efficiency.

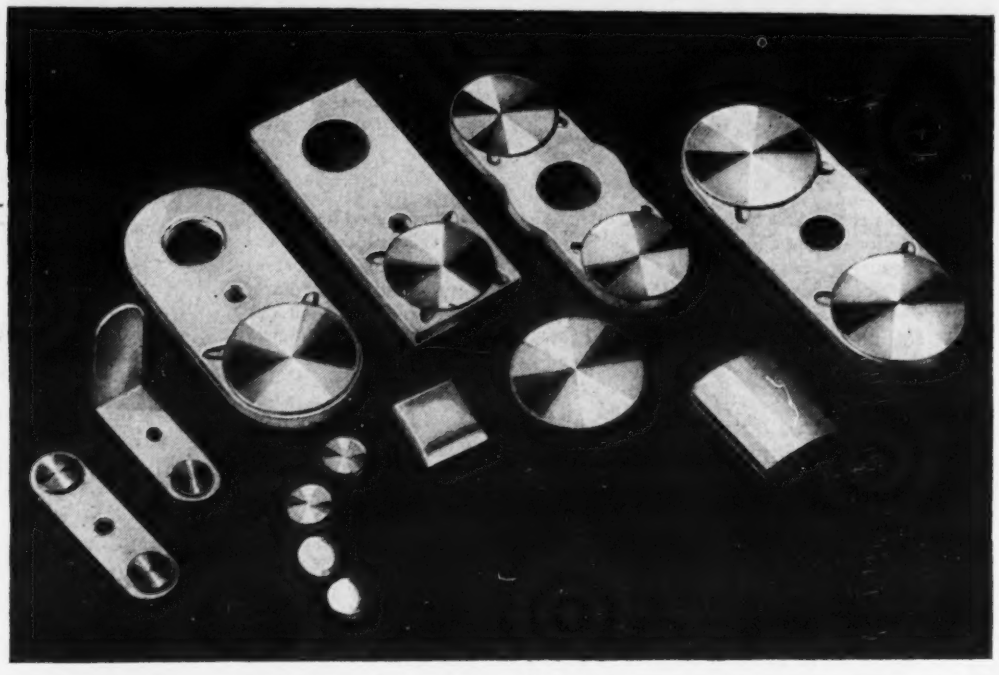
The Sturdee *Solid Shank* Spoon is forged in one piece from a solid bar of steel—blade, shank and socket are all one—no seams, laps or welds to break in service.

A chain is no stronger than its weakest link. The Sturdee Solid Shank Spoon has no weak spots. Its strength is matched and balanced. Every power, light, or communication company who has tried this spoon, now specifies it to the exclusion of any other type. To start a program that will save cost and increase efficiency, use Sturdee Solid Shank Spoons.

STURDEETOOLS
a TRUE TEMPER PRODUCT

Western pattern. Sturdee Solid Shank Heavy Duty Spoon. Blade, shank and socket forged in one piece from a solid bar of steel. 13 gauge, heat treated blade. XX grade hickory or ash handle — lengths 6 feet to 12 feet.

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States



New Developments in MALLORY Electrical Contacts *from Powdered Metals*

Typical Physical Properties
(as annealed)

MALLORY D-52
(Powder Metal)

Conductivity %IACS	87-95
Hardness (Rockwell F)	15-25
Tensile Strength PSI	24,000
Density (Grams per CC)	10.1
Density (Tr. Oz. per In.³)	5.33

MALLORY D-53
(Powder Metal)

Conductivity %IACS	80-90
Hardness (Rockwell F)	25-35
Tensile Strength PSI	16,000
Density (Grams per CC)	10.0
Density (Tr. Oz. per In.³)	5.28

MALLORY D-54
(Powder Metal)

Conductivity %IACS	70-80
Hardness (Rockwell F)	35-45
Tensile Strength PSI	16,000
Density (Grams per CC)	9.8
Density (Tr. Oz. per In.³)	5.17

New developments in the powder metallurgy field have made possible the introduction of three new members to the Mallory powdered metals group. Identified as Mallory D-52, D-53, D-54, they offer all the distinctive qualities of Silver-Cadmium Oxide*, but with varying characteristics of ductility, conductivity and resistance to arcing and welding.

Contacts made of Mallory D-52, D-53 and D-54 have shown outstanding performance in aircraft relay installations, their resistance to arcing being ideal for high current applications. By selecting the proper grades satisfactory service up to 28 volts DC and, in carrying and interrupting current, up to 2400 amperes can be obtained.

While your designs are still in the blueprint stage, consult Mallory on contact problems. Mallory metallurgical engineering, with years of experience in the development and production of electrical contacts, will save time and help break "bottlenecks".

Start today by writing for a free copy of the Mallory Contact Data Book (engineering data on contact applications) and the new Mallory Contact Catalogue (complete information on designs and specifications).

P. R. MALLORY & CO., Inc.
INDIANAPOLIS 6, INDIANA

Buy War Bonds

*Patented

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL PARTS

Royal-ettes

#1 *in a series of informative news letters from a producer of Power Switching Equipment.*

This is the first time Royal Electric Mfg. Co. has ventured into print in a long, long time. Not that we haven't had anything to talk about, because we have. But we've just been too busy to keep up our normal business contacts. Having Pick Warren in the Navy hasn't helped any either. So we're taking this space in Electrical World to tell our old customers—and newcomers in the field—that we'll be anxious to serve them when the lid is off, and how, and why.

To give you a little history, Royal was incorporated under the laws of Illinois, starting from scratch back in 1914. There weren't many competitors in those days, so today we are one of the oldest manufacturers in the Power Switching Industry. We are not anywhere near the largest, nor do we particularly aspire to be. Our desire is to remain a small compact outfit, because we intend to retain the flexibility and speed of action that have become our greatest assets. We'll try to show you what we mean in this series of letters.

We want to move forward in step with the progress of the utilities and the industrials. If our type of engineering, manufacturing and sales methods do result in a physical increase in the company, then so be it. But such growth will have to come from producing better and more useful equipment. We are set on maintaining a flexible organization that can shift easily and quickly to meet the new requirements of the power utilities and industrials. As long as we can do this, we will be able to perform a real service, and will be entitled to our fair share of business, with the profits accruing therefrom.

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

of all Vinylite plastic compounds for use in conjunction with wire and cable insulation. After graduation from Stevens Institute, Mr. Brister became a service engineer for the bonding materials division of Bakelite Corp. In 1939, he was transferred to Halowax Products Division of Union Carbide & Carbon Corp.

•

New Appointments Made by Allis-Chalmers Co.

Several new appointments have recently been made by the Allis-Chalmers Mfg. Co. A. J. Schmitz has been named Pacific regional manager, according to an announcement by Frank Angle, manager of district offices of the company. Previous to his new appointment, Mr. Schmitz was manager of the company's Seattle office and prior to that, manager of the Portland office. He has been with the Allis-Chalmers organization since 1914.

Earl Lancaster has recently joined the Los Angeles district office as a specialist in switchgear and related equipment and E. J. Baireuther has been assigned to the Denver office as specialist in electrical apparatus and in cement, crushing, and mining machinery. Mr. Lancaster started with Allis-Chalmers in 1925 and Mr. Baireuther in 1942.

R. W. Davis has recently been appointed general manager of the Norwood, Ohio, works. He was formerly an assistant manager of the company's electrical department at Milwaukee, but for nearly two years has been on leave serving as director of the electrical equipment branch of WPB.

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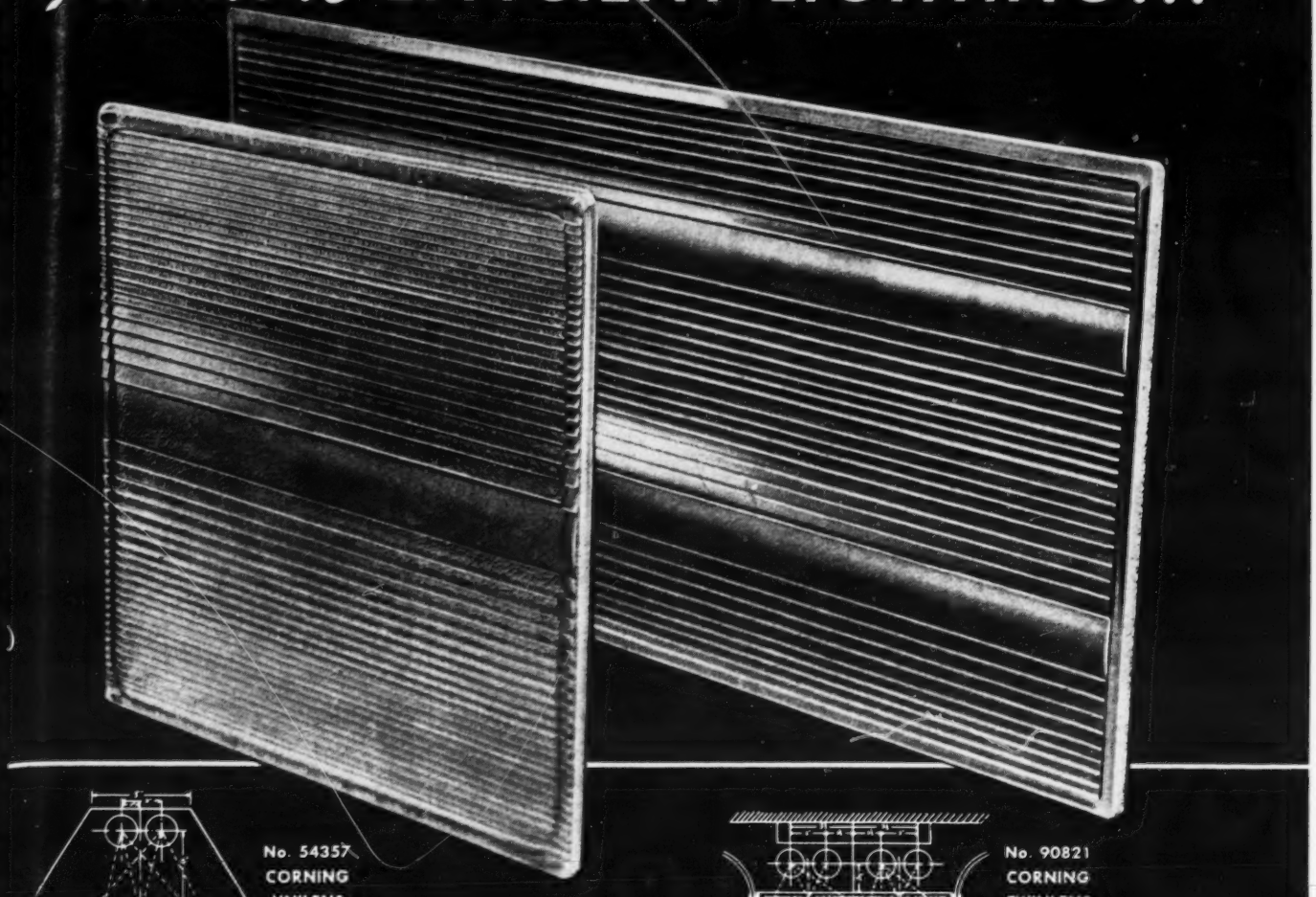
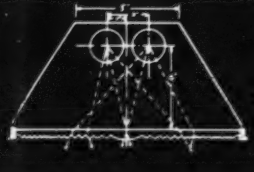
► W. Paul Jones, vice-president in charge of the refrigerator division of Philco Corp., has been elected chairman of the OPA domestic mechanical refrigerator industry advisory committee.

► Melvin C. Wilt, released from active duty as a Lieutenant-Commander in the Supply Corps, U.S.N.R., has returned to carry on his previous duties as executive vice-president and general manager of Curtis Lighting, Inc., and president of Curtis Lighting of Canada, Ltd.

► Rolf Selquist, since 1928 electrical engineer of the Copperweld Steel Co., Glassport, Pa., has been appointed consulting engineer. In his new position Mr. Selquist will act as consultant to the management of the Glassport division and will report directly to W. McIlvane, executive vice-president.

For more EFFICIENT LIGHTING...





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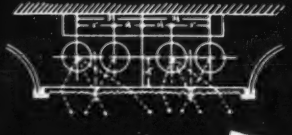
CORNING
UNILENS



No. 90821
CORNING
TWINLENS

VERSATILE CORNING UNILENS AND TWINLENS FLUR-O-GUIDE PANELS

Here are Corning Flur-o-guide Unilens and Twinlens panels that can be used for either concentrated or wide angle light distribution . . . to provide light that is engineered for specific direct lighting applications.

Although primarily intended for use in troffers fitting into acoustical tile ceilings, the lenses illustrated will find wide use in surface mounted or suspension luminaries.

Corning Unilens (*Code No. 54357*). Since this lens is 11″ wide x 12″ long, it is adaptable to multiple use with fluorescent lamps from 24″ to 60″ long.

Corning Twinlens (*Code No. 90821*). Approximately 11″ wide x 24″ long. This lens is designed for using two 24″ or 48″ fluorescent lamps or of multiple length lamps. Also available is Corning Twinlens (*Code No. 54358*), approximately 11″ wide x 12″ long, which may be used with fluorescent lamps of any standard length.

Lighting data sheets showing suggested applications of Corning Unilens and Twinlens panels for general and localized lighting are available. Write for Lighting Data booklet, showing the complete line of Flur-o-guide lenses and panels. Lighting Sales Dept., EW12, Corning Glass Works, Corning, New York.

Whatever Your Lighting Problems... Specify Corning Flur-o-guides

CORNING FLUR-O-GUIDES
Are Available for
GENERAL LIGHTING
SUPPLEMENTARY LIGHTING
LOCALIZED LIGHTING

For Special Effects in
Commercial Interior Lighting
STORES SCHOOLS
THEATRES MUSEUMS
BANKS HOTELS
OFFICES HOSPITALS

Recommended for Industrial
Plant Lighting, General Illumination
and Localized Lighting
INDUSTRIAL PLANTS PRIVATE AND
ASSEMBLY LINES GENERAL OFFICES
INSPECTION AREAS ELECTRICAL
LABORATORIES INSTRUMENT
DRAFTING ROOMS PANEL BOARDS

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means
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Corning Engineered Lightingware
BRAND

NOW YOU CAN WELD GALVANIZED IRON AND STEEL

sheets, shapes and pipe and leave all surfaces

100% RUST AND CORROSION PROOF

by regalvanizing the seams and joints with the

GALV-WELD PROCESS

Obsoletes Riveted, Bolted Construction

- **Fast**
- **No Fumes**
- **Permanent**
- **Economical**
- **Easy to use**
- **No Sandblasting**
- **No Flux Required**
- **Applied in any position and in confined quarters**
- **Cannot be pried or peeled off**

Especially applicable in the case of all welded, stronger, easier erected, lower cost transmission towers; repair of sub-station galvanizing; and transformer cases.

Production-proved in wartime service, Galv-Weld Alloy (Reg. Trade-mark) has withstood all government tests, and is equal to and/or better than hot dip galvanizing in corrosion resistance. The bond to the base metal is superior to zinc metal spray.

GALV-WELD PRODUCTS

399 E. 2nd St., Dayton, Ohio

Please send, without obligation, information on the Galv-Weld Process and sample of Galv-Weld Alloy.

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OBITUARY

Paul M. Downing

Paul M. Downing, executive vice-president of the Pacific Gas & Electric Co., San Francisco, whose death was announced in the December 16 issue of ELECTRICAL WORLD, page 6, spent a lifetime in the development of the P.G.&E. system. His accomplishments in the field of electrical engineering were outstanding and he was credited with playing an important part in the development of many improvements in the utility industry.

Mr. Downing was born at Newark, Mo., in 1873 and was graduated from Stanford University in 1895. Two years later he became station superintendent

of the Blue Lakes power house of the Blue Lakes Water Co., this unit being one of the earliest of California hydro-electric developments which later became a part of the P.G.&E. system. During this time the utility industry was passing through a stage of consolidation of scattered systems and under the leadership of John Martin, who was to play a prominent part in the development of the utility industry in California, and his associates, the Bay Counties Power Co. was formed and later merged into the California Gas & Electric Corp. After serving as division superintendent of the Bay Counties Co., he was later made superintendent of substation and operating engineer for the California Gas & Electric Corp. When, in 1905, Pacific Gas & Electric was incorporated by merger of the California Gas & Electric Corp. and the San Francisco Gas & Electric Co., Mr. Downing continued in the position of superintendent of substations and operating engineer until 1908 when he was appointed engineer of operations and maintenance. He served successively as chief engineer, vice-president in charge of electrical operations, vice-president in charge of electrical construction and operations, first vice-

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No *handcranking.* No *levelling.* No *shocks.* Accurate easy reading of insulation resistance testing in any position. Every electrical field, every electrical industry, every electrical department dependably served by VIBROTEST with range of 0-200 megohms at 500 volts from self-contained power source. Potential 0-2,000 ohms, 150-300-600 volts DC or AC. Here is reliable CRANKLESS INSULATION RESISTANCE TESTING in its handiest, most modern form.

VIBROGROUND—

Simply press button for positive determination of resistance of all ground connections. Protects life and property. Open scale direct reading. No calculations necessary. No reverse readings nor polarization errors. "Strays" excluded. Time saving. Cost saving. Two types—one for average ground conditions, another for extremes of dryness and moisture.

Prompt deliveries. Send for Engineering Bulletins on these sturdily encased portable and essential units. Write

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221-C So. Green St., Chicago 7, Ill.

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president and general manager and executive vice-president.

Paying tribute to his old friend and co-worker, James B. Black, president of Pacific Gas & Electric Co., said of Mr. Downing: "We who were associated with him for so many years knew and appreciated the unchanging integrity of his thinking, the breadth and depth of his technical and executive knowledge and the rich human qualities of courage, patience, sympathy and understanding with which he was endowed. His great contribution to the public utility industry, to the advancement of which he devoted his life, will stand as his memorial . . ."

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▶ PETER J. MULVEY, inventor of the Mulverized sparkless brush and one of the last surviving members of the Edison Pioneers, died in Schenectady, N. Y., on December 11 at the age of 70. Mr. Mulvey had served the General Electric Co. for 42 years. A native of Edinburgh, Scotland, Mr. Mulvey came to the United States in 1888 and first worked for the American Locomotive Co. In 1891 he joined the old Edison works, which in 1892 became the General Electric Co. In 42 years, until his retirement in 1933, he trained 7,000 test men in Schenectady and in Erie, Pa., for General Electric. The most important accomplishment in his career was the invention of a sparkless brush, a vital part of every electrical motor.

▶ OSCAR E. FLEMING, well known Canadian corporation counsel, died in Toronto on November 29 in his eighty-fourth year. He had been in ill-health for several years. A personal friend of the late Sir Adam Beck, with whom he was associated in the campaign for establishment of the Ontario Hydro-Electric System, he also was connected with the formation of Canadian Deep Waterways and Power Association and was president of the organization during the campaign which resulted in the adoption of a favorable St. Lawrence improvement policy by the federal government.

▶ FRANCIS W. HURLBERT, who retired in 1936 after many years as an electrical sales engineer of the International General Electric Co., died at his home in Hartsdale, N. Y., on December 4. Born in Aurora, Ind., he was graduated from the Rose Polytechnic Institute in 1891. Early in his career, Mr. Hurlbert was associated with the late Elmer Sperry at the Cleveland plant of the old Brush Electric Co. In 1901 he had charge of the General Electric exhibit at the Pan American Exposition in Buffalo. He was 74 years old.

▶ GUY N. CHAMBERLAIN, for many years head of the street lighting division of the General Electric Co. at Lynn, Mass., and later general engineering assistant to the works manager, died recently at Swampscott, Mass. He was graduated from Purdue University in 1893, and in 1905 was transferred to Lynn as lighting engineer after two years at the Schenectady works. During his 46 years of service prior to retirement he was widely known throughout the country as a lighting specialist.

▶ WILLIAM L. RUNZEL, SR., chairman of the board of the Runzel Cord & Wire Co., died at his home in Chicago on December 11 in his seventy-third year, after a brief illness. Mr. Runzel had devoted almost his entire business life to the manufacture of wire and cable and telephone cords, commencing his business career with the Western Electric Co. of Chicago in 1888. He was co-founder of the Runzel-Lenz Electric Manufacturing Co. as well as the founder of the present Runzel Cord & Wire Co. of Chicago.

▶ WILLIAM L. BLISS, inventor, developer and manufacturer of car-lighting apparatus used on railroads, died at Niagara Falls, N. Y., on December 5. He was 73 years of age. Mr. Bliss was an electrician for the Riker Electric Motor Co. and the Consolidated Gas Co. of New York before founding his own company the Bliss Electric Car Lighting Co. in 1900. When that organization was merged with several others to form the United States Light & Heating Co. he became chief engineer. He also served as chief engineer of the company's successors, which included the United States Light & Heat Corp. and the U. S. L. Battery Corp. Mr. Bliss retired in 1941, but continued to act as consulting engineer. A fellow of the American Institute of Electrical Engineers, he had to his credit many patents on electrical devices.

▶ ALF HJORT, chief engineer of the George H. Flinn Corp., engineers and contractors, New York, died on December 12 at his home in that city in his sixty-eighth year. Born in Oslo, Norway, Mr. Hjort received his technical education at the State Polytechnic Institute of Berlin and for a time was a designer with the General Electric Co. in Berlin. Coming to the United States in 1903, he served as electrical engineer on the Pennsylvania tunnels for Pearson & Co. from 1904 to 1909. From 1909 to 1911 he was connected with the Begnon Contracting Co., joining the Flinn organization in 1911. He became chief engineer in 1929. Mr. Hjort was a member of the A.I.E.E.

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Save Time

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

Save Copper

by using these connectors which are good as new after being salvaged.

EASY TO INSTALL
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Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES

MANUFACTURING MARKETS

Record Output Awaits War Developments

Following the annual meeting of the Vacuum Cleaner Manufacturers Association, held in Cleveland, Ohio recently, a statement was released to the effect that the manufacturers, realizing their responsibility to provide vacuum cleaners in greatly increased quantities to maintain the high standards of American homes, are prepared to resume production at a record rate of the earliest date feasible in harmony with the war effort.

The statement said in part: "Some misunderstanding has arisen in the minds of the trade and public as to the likelihood of early resumption of quantity production of vacuum cleaners. It should be borne in mind that the changed war conditions have recently brought about greatly increased military requirements, which will definitely delay the production of vacuum cleaners and perhaps make available only a very limited quantity during the early part of 1945.

"Members of the vacuum cleaner manufacturing industry have indicated their intention to continue as in the past, to make available their manufacturing facilities and cooperate wholeheartedly with the military authorities in supplying a maximum of products to meet increased war demands. . . It is the prediction of vacuum cleaner manufacturers generally that large volume production must await the successful development of the war."

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Formica Insulation Installs New Unit

Formica Insulation Co., Cincinnati, now has in operation an enlarged modernized boiler plant, representing an expenditure of $155,000 and designed to enable the plant to carry the continuing heavy war production schedule.

George H. Clark, vice-president in charge of engineering said that the improvement which increases steaming and stack capacity 60 percent will also place the plant in better position for meeting production demands for postwar products.

The new high capacity boiler unit with its modern stoker, together with the two old boilers still in operation will give the plant a safe total steaming capacity of 85,000 pounds per hour as compared with a 1943 winter safe capacity of 52,000 pounds per hour. The new boiler, together with one of the old boilers will readily carry the plant's heaviest loads and permit taking a boiler out of service for repairs.

Installation includes new boiler feed water conditioning equipment, complete steam metering and combustion control equipment and an automatic system of ash handling. The power plant piping system has been modernized.

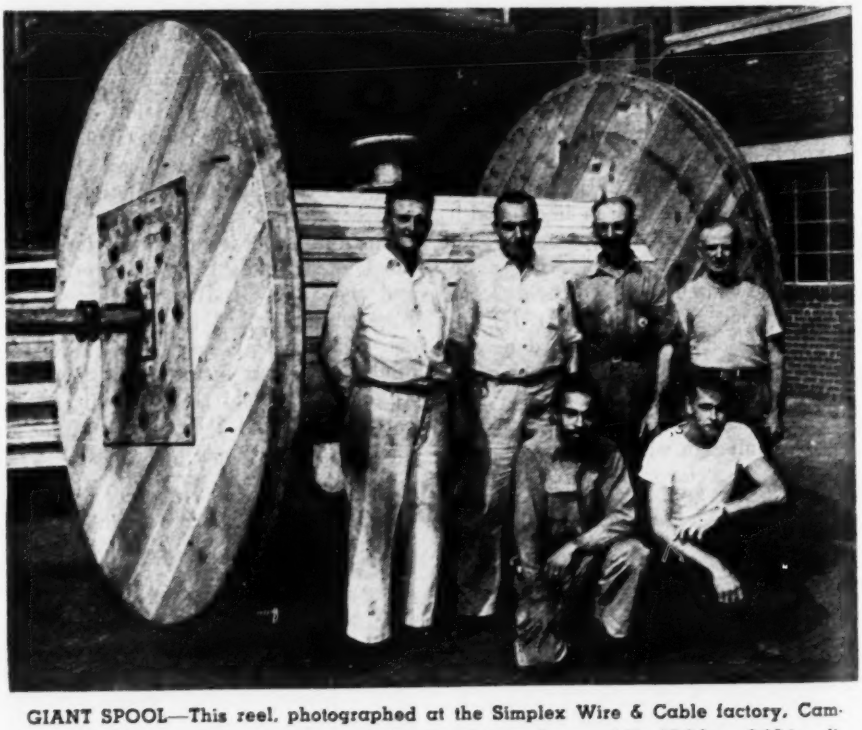
Fiber Glass Gains in Insulation Seen

Although fiber glass insulation within the past five years has made a heavy foray into the use of cotton and asbestos as insulating materials in electrical equipment, marketing plans of the Owens-Corning Fiberglas Corp. call for an even greater share in this market.

Production of Fiberglas, the Owens-Corning product, has risen from 250,000 pounds in 1939 to 3,700,000 pounds in 1943, a figure which will be exceeded "considerably" by this year's production. Jan S. Irvine, New York branch manager for the company, declared at a recent exhibit of wartime applications.

Approximately 15 percent of all electrical equipment is now manufactured with some fiber glass insulation, A. Winsor Brown, manager of the exhibit, stated. However, within five years the company expects this "acceptance" of the material's properties to grow to a point where 35 percent of all electrical equipment will use it.

To maintain production of Fiberglas after the electrical equipment industry's demands fall back to normal, the company is also preparing to market the product in decorative fabrics.



GIANT SPOOL—This reel, photographed at the Simplex Wire & Cable factory, Cambridge, Mass., was built to carry 2,500 ft. of 3-conductor, 4/0, 13.8-kv., 3.32-in. diameter, submarine cable made and shipped in one length. The reel is the largest made by Simplex in the past three years, being 8 ft. high, about 8.5 ft. wide and weighing with steel axle, 3,361 lb. Built of spruce and pine, its loaded weight is about 15 tons. The tiny 14-in. reel on top, shown for contrast, is used in transferring short lengths of small wire between departments, and is the smallest made in the yard. The reel builders, left to right, are Bill Prouty, foreman Frank Sheehan, Dennis LeForte and William Mullin. Front row, C. Perinchief and H. MacGilvray

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

C. O. Jelliff Mfg. Corp. has appointed the R. B. Dana Co., 101 Park Avenue, New York 17, N. Y., representatives for the New York metropolitan territory, part of Connecticut and New Jersey, for Jelliff fine resistance wire for use in fixed resistors and electric heating elements. Representation covers resistance wire only, and does not include Jelliff screen cloth and wire-mesh fabricated parts.

American Central Manufacturing Corp., Connersville, Ind., has transferred Glenn A. Heilman from the engineering to the sales department and in his new capacity he will become district manager for the company in Cleveland, Ohio.

Graybar Electric Co., Inc. has appointed J. E. House manager in San Antonio, replacing J. E. Lowrey who will retire early next year, and E. R. Yonkers manager in Omaha, replacing T. W. Conrad, retired. Other sales assignments made by Graybar in the past few months include: J. A. Mayer, Atlantic District manager with headquarters in Philiadelphia. A. L. Hallstrom, now Atlantic District manager, will act in an advisory capacity until January 15, when he will retire after 50 years of service. Mr. Mayer's jurisdiction will include the Graybar offices and warehouses at Allentown, Pa.; Baltimore, Md., Harrisburg, Pa., Reading, Pa. and Washington, D. C. Mr. Mayer brings to his new position more than 31 years of experience with the company. A. D. Hammond has been named southern district manager with headquarters in Atlanta; G. T. Marchmont, southwestern district manager with headquarters in Dallas, succeeding M. A. Buehler, retired; R. W. Kimberlin, Mississippi Valley district manager with headquarters in St. Louis, with jurisdiction over office and warehouse in Memphis, Tenn., as well as those in St. Louis; S. B. Cooper, manager in Salt Lake City and L. B. Westfall Ohio Valley district manager with headquarters in Cincinnati.

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Monarch Perfects Process for Sole Plate Output

Monarch Aluminum Mfg. Co., Cleveland, has announced the perfecting of a special mechanized process for casting, machining and completely finishing aluminum sole plates for electric irons and electric steam irons.

The new aluminum casting, according to Raymond Deutsch, Monarch president, is not only of a superior quality and density of structure, but, ready for installation, and low in price. The permanent mold method is used.

•

Watco Engineering Moves

Address of Watco Engineering, Inc., has been changed from 12435 Euclid Avenue to 2200 Scranton Road, Cleveland, Ohio.

Read...

THE JAEGER SPEED INDICATOR

at your convenience

This compact watch-like speed indicator holds the reading in rpm after disengagement from the rotating part, thereby eliminating the necessity of reading the instrument while in operation. It consists of a non-magnetic watch movement combined with a simple revolution counter to time the revolutions of the unit under test for a period of six seconds. The hands stop automatically at the points indicating the average speed during the time interval of testing, and the indicated reading in rpm may be made when convenient.

The Jaeger Speed Indicator can also be used to measure linear or peripheral speeds by replacing the rubber spindle tip with the rubber-tired pulley supplied with each instrument. The dial readings divided by 2 indicate speed in feet per minute.

Jaeger instruments are supplied in two models—for low speeds up to 2000 rpm in divisions of 1 rpm readable to 0.5 rpm and for high speeds up to 10,000 rpm in divisions of 10 rpm readable to 5.0 rpm. Accuracy is ½ of 1% of dial readings.

Write for Bulletin 1750-W

Jaeger Speed Indicator in carrying case. Accessories include 2 shapes of rubber spindle tips and one rubber-tired pulley. Case measures 3½" x 4⅞" x 1½". Weight, complete, 11 oz.

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

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Simplify the installation and testing of watthour meters and relays.

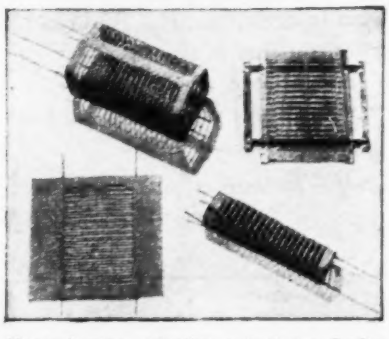
The many features built into States Type SJ Test Blocks include:

1. **No live parts extend beyond the base—an important safety feature.**
2. **Mounted on either solid or unit bases, a wider pole selection is available**
3. **Angle bent studs permit quickly changing front connection blocks over to back connection. No detail is overlooked in the mechanical and electrical construction of these Test Blocks. The thousands of States Blocks which are giving unfailing service year after year provide the best proof of the durability of these well designed, well built blocks. See Cat. 1, Sec. 9.**

BINDING POSTS PLUGS—RECEPTACLES

See Cat. No. 1 Sec. 8D

Ohm-spun RESISTORS



Non-inductive, ideally suited for Radio Transmitters, Loading Equipment, and for many other uses where reliable performance is a necessity. See Cat. 1, Sec. 5.

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Test Blocks ..... Binding Posts ..... Resistors .....

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Field Reports on Business

War programs are undergoing a sharp revision upward, now that the prospects of an early victory in Europe have been dimmed. However, announcements of post-war programs offer an encouraging note. In the electrical field wire sales are substantial and wiring supplies are in demand.

PACIFIC COAST

Deliveries of most staple wiring devices and roughing-in material have steadily improved until they are approaching a pre-war basis; but certain small but essential items, such as flexible metallic conduit couplings and connectors, and even locknuts, are difficult to procure, and their prices are frozen at the low levels of Oct. 1, 1941.

Prospective orders include material for relighting Mare Island machine shops and requisite wiring for control changes; a low bid of $278,657 for labor and material for the 161 kv. transmission line from Davis project in Arizona and Nevada, and the 53-mile drain power line near Eugene, Ore., to connect with Bonneville System.

Industrial developments feature varied Government awards to coast plants, such as $1,188,000 of refrigerated boxes for barges to a San Diego firm; $500,000 of power barges to an Aberdeen, Wash., firm; and 800 units of troop barracks for Albany, Ore., manufacture.

Vice-President E. O. Shreve of General Electric Co. speaking recently in Los Angeles, declared that his company's purchase of two large industrial sites in California indicated its faith in the post-war industrial growth of the Pacific Coast.

Major electrical appliance business assumed some of its old-time importance during the holidays because of prevailing keen competition among manufacturers and distributors for strategic outlets, though midsummer of 1945 is the most optimistic prediction for merchandise in sufficient quantities to equip them.

NEW ENGLAND

Public Service Co. of New Hampshire is installing a 2-section, 3-unit Cottrell precipitator at its Manchester steam plant and has been authorized to resume construction of a 10,000-kva (initial rating) 110/66/4-kv outdoor substation at Nashua to serve six and later 12 distribution circuits. The company has rebuilt 7.5 miles of 66-kv single-circuit line with wooden H-frame design between Hillsboro and Keene. New England Telephone has installed a 5-position multiple switchboard for the Submarine Signal Co., Boston, which occupies buildings in 16 different locations throughout the city. Work on installing flashing beacons and floodlights on the B. and M. R. R. bridge, Point of Pines, Revere, Mass., will be started immediately. A second class airport for Lowell, Mass., is proposed in the present national airport expansion plan presented to Congress with lighting facilities that will cost approximately $26,000.

New England state commission and municipalities are planning to embark on a huge construction program as soon as restrictions on the use of materials are withdrawn. The Massachusetts Emergency Public Works Commission has listed projects which involve the expenditure of about $160,000,000. Included in this program are plans for new power plants, additions to hospitals, and addition to the state offices.

Electric furnace manufacturers are faced with a spotty demand, although one manufacturer reports, many inquiries as to future improvements which have grown out of the war demands. All wiring supplies move almost wholly on Navy preferentials; bidding on Navy schedules is less active and restrictions still hold against holiday season illumination although many municipalities are going ahead and installing Christmas tree lighting.

NEW YORK

With the prospects of an early victory in the war in Europe dimmed by recent developments, war programs have undergone a sharp upward revision.

Civil engineering construction volume in continental United States totaled $31,757,000 last week. This volume topped the preceding week by 75 percent and represented an increase of 19 percent over the total reported to Engineering News-Record for the corresponding 1943 week. Public construction for the week was 68 percent and 31 percent higher, respectively, than the preceding week and a year ago. Private construction was up 159 percent compared with the preceding week, but was 29 percent below the 1943 week. The week's construction brought 1944 volume to $1,686,378,000 for the 50 weeks, a decrease of 44 percent from the $2,999,009,000 reported for the period in 1943.

Urged on by warnings of shortages and mail delays, Christmas shoppers in the Metropolitan district broke sales records for almost every type of merchandise last week, department store officials reported. Estimates put department store volume at about 22 percent or more ahead of the similar week of 1943.

CHICAGO

Releases from WPB have been obtained in the last few months for a number of generating units in both industrial and utility field where extreme urgency has been apparent. In addition, the sale of distribution transformers has been quite substantial and a few large power transformers have also been sold, one major electrical manufacturer in this area reports. However, there appears to be no further need for power equipment for military installations in this country and only in the case of very special demands has there been any sale of equipment for such installations outside of the country. This source of orders has fallen off accordingly. Although it was expected that WPB would release a substantial amount of equipment the first of the year, the fact that such release has not come controls the amount of new business, in this and other areas of the country, it was indicated.

Announcements of post-war plans and programs, however, continue to offer an encouraging note. After the war the Chicago Surface Lines has announced that it will buy new trolleys, buses and street cars costing a minimum of $16,627,250 with a maximum of $19,000,000 if prices should rise. The new equipment would consist of 798 trolley and gasoline buses and 386 street cars it is reported here.

Manufacturers Declare Dividends on Common

Several electrical manufacturing companies have recently declared dividends on common stocks.

The 45-cent dividend declared on the common stock of Cutler-Hammer, Inc., brings 1944 disbursements to $1.50, or 25 cents more than last year.

A dividend of 25 cents has been ordered on the common stock of the Clark Controller Co. Previous payments this year were 50 cents quarterly. Dividends for 1944 will total $1.75 against $2 last year.

Directors of the Worthington Pump & Machinery Corp. have declared a dividend of $1.50 on the common stock, payable December 20, and a dividend of 37½ cents on common share, payable March 20, 1945. Stockholders received one dividend in 1943 —$2 on December 20.

A year-end dividend of 40 cents a share has been declared on the common stock of the Philco Corp. for payment December 27, increasing 1944 disbursements to $1.20 from $1 distributed in 1943.

•

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Vacuum impregnation of coils, armatures, transformers, etc., under pressure is demonstrating many advantages, according to Vacuum Impregnating Works, Chicago, Ill.

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•

Corporate Name Changed

Celanese Celluloid Corp., selling organization for the plastics products manufactured by the Celanese Corp. of America, has changed its name to Celanese Plastics Corp. The management felt that the new name will more comprehensively convey to the buying public the nature of the company's business.

•

Forms Educational Unit

Formation of a new educational department, coordinating all of the company's relations with schools, colleges and universities, has been announced by the Westinghouse Electric & Manufacturing Co. The new department will be located in Pittsburgh, Pa.

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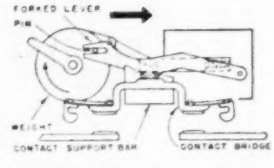

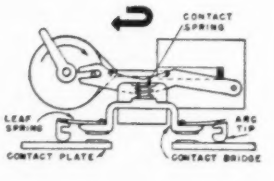

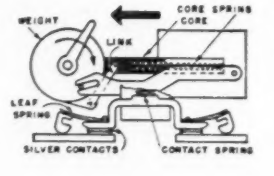

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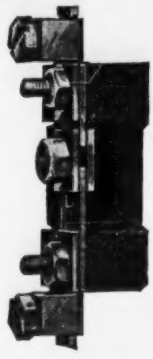
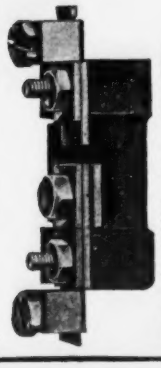


SECTIONAL VIEW ABOVE SHOWS LINK CLOSED. RIGHT, OPEN.



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Sales Opportunities

INDIANA—Indianapolis Power & Light Co., Indianapolis, has plans maturing for addition to power plant, for expansion in steam division. New boiler unit will be furnished by Babcock & Wilcox Co., and contracts for auxiliary equipment will be placed at early date. Bids on general construction contract will be asked soon. No estimate of cost announced. Gibbs & Hill, Inc., Pennsylvania Station, New York, N. Y., is consulting engineer.

IDAHO—Idaho-Montana Pulp & Paper Co., care of W. F. McNaughton, Coeur d'Alene, attorney and representative, recently organized, has preliminary plans under way for two new pulp and paper mills; negotiations are in progress for acquisition of suitable sites. Each plant will comprise several one and multi-story buildings for wood pulp mills and paper-making divisions, and is estimated to cost in excess of $1,000,000, with machinery and electrical equipment. It is understood that project will be carried out as a post-war development.

MINNESOTA—Water Department, Staples, has plans for new power substation at waterworks pumping plant, with installation of transformers, switchgear and auxiliary equipment to handle power service at 33,000 volts and stepdown to 2,300 volts for station operation. Bids for building construction are being asked and work will begin soon. Project has a priority rating.

ALABAMA—War Department, Washington, D. C., has authorized mechanization of manufacturing plants at arsenal, for increased ammunition production, including installation of mechanical and electrical equipment for loading, conveying, elevating and other operations. No estimate of cost announced. Bids are scheduled to be asked at early date by commanding officer at arsenal.

NEBRASKA—Light and Power Department, Madison, plans extensions in primary and secondary lines for expansion in rural electric system, with service from municipal power station. Application has been made for permission.

OREGON—Bureau of Reclamation, Denver, Colo., plans call for bids in near future for construction of pumping plants "E" and "F" on Tule Lake Division, Modoc Unit, Klamath project, Klamath, to include installation of motor-driven pumping machinery, controls and auxiliary equipment.

TEXAS—Public Works Department, San Antonio, plans expansion and modernization of city fire alarm system as a post-war project, including extensions to municipal airport, with installation of signal stations and main central station. Cost estimated about $325,000.

WISCONSIN—Wisconsin Power & Light Co., Madison, has hearing scheduled before State Public Service Commission on January 2, on application for permission to proceed with proposed addition to generating plant, initially projected a number of months ago. Installation will include new turbine-generator unit, high-pressure boiler

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and auxiliary equipment. At the same time, application will be heard for proposed extensions in transmission lines. Entire project is estimated to cost about $2,970,000.

INDIANA—Light and Power Department, Washington, will receive bids until 2 p. m., January 2 for extensions and improvements in municipal power plant, including installation of new 5,000-kw. turbine-generator unit, surface condenser, water circulating pumps, motor-driven condensate pumps and auxiliary equipment, with 20-ton hand-operated traveling crane. Board of Public Works is in charge. Bevington, Taggert & Fowler, Inc., Indiana Pythian Bldg., Indianapolis, is consulting engineer.

IOWA—Firestone Tire & Rubber Co., 1200 Firestone Parkway, Akron, Ohio, has contracted with government for further expansion in new rubber mill now in course of construction, including additional buildings with installation of machinery and electrical equipment. Cost estimated about $1,500,000, with financing by Defense Plant Corporation. This will make total cost of project of about $6,100,000. Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich., is architect and engineer.

ARKANSAS—Public Works Department, West Memphis, has plans under way for three new motor-driven pumping stations in connection with extensions and improvements in sewage system, with pumping units, controls and auxiliary equipment. New plants will replace two existing old stations. Proposed to ask bids early next spring. Entire project will cost about $175,000. Marion L. Crist & Associates, Union Life Bldg., Little Rock, are consulting engineers.

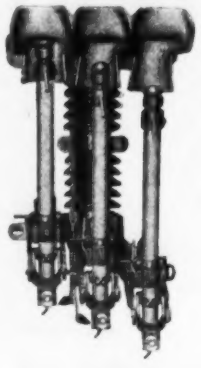
NEBRASKA—Nebraska Power Co., Omaha, has secured state permission for extensions in primary and secondary lines. Work is scheduled to be placed under way soon.

ILLINOIS—Construction Service, Veterans' Administration, Washington, D. C., will receive bids until January 16 for additional buildings at institution, including complete electrical installation, with underground distribution lines, lighting facilities, electric elevators, ventilating system, service connections and other electrical equipment.

MISSOURI—Municipal Airport Department, Municipal Air Terminal, North Kansas City, has plans under way for new hangar and shop, to be occupied by Mid-Continent Air Lines, Inc., same address, under lease. Hangar will be about 130 by 150 ft., with shop and office unit, 160 by 200 ft. Cost estimated about $200,000, with mechanical and electrical equipment. Proposed to ask bids early in 1945. Neville & Sharp, 1221 Baltimore St., Kansas City, are architects.

CALIFORNIA—Board of Works, Modesto, plans extensions in street-lighting system as a post-war project, including improvements and replacements in present installation. Cost estimated close to $150,000. F. J. Rossi, City Hall, is city engineer, in charge.

ALASKA—Ketchikan Public Utilities Department, Ketchikan, will receive bids until January 11 (tentive date) for proposed municipal hydroelectric power development, estimated to cost $400,000. Roy W. Johnson, Hoge Bldg., Seattle, Wash., is consulting engineer.



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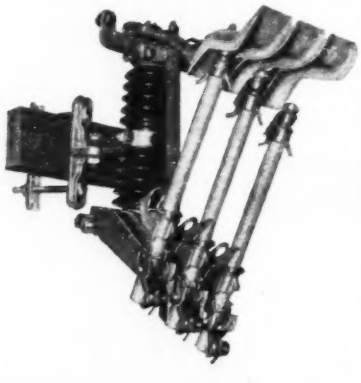

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Recent Rate Changes

NEW JERSEY POWER & LIGHT CO.'s residential and commercial electric customers will receive a 50 percent credit of one month's billing of meter readings made between December 1 and December 31, 1944, according to an announcement by the New Jersey Power & Light Co. and the New Jersey Board of Public Utility Commissioners. Under the Rate Adjustment Plan, there has been filed with and approved by the Board of Public Utility Commissioners a revised tariff of New Jersey Power & Light Co. which will distribute $129,000 to residential and commercial customers as billing credits. The rates of New Jersey Power & Light Co. are now controlled by the terms of the Rate Adjustment Plan, which was approved by the board a year ago. This, according to the company, is the fifth customer dividend in the past three years.

CITY OF NORTH LITTLE ROCK, ARK., will pass on to electric customers approximately $29,800 a year in rate reductions possible because of lower rates made by Arkansas Power & Light Co. to the municipality under a new wholesale-for-retail rate, Mayor O. W. Neely has announced. Residential customers will get a $15,250 annual reduction, commercial customers will get $5,250 a year in reductions, and industrial customers will get $9,300 a year in reductions. In addition to the rate reduction, North Little Rock's general fund will receive $3,600 more per year in taxes on the power company's poles in the city.

MANITOBA POWER COMMISSION has announced that electric rates for nine rural municipalities have been reduced. The towns affected are Eden, Franklin, Kelwood, Riding Mountain, Laurier, Ste. Rose du Lac, Makinak, Ochre River and McCreary. The first block for domestic service will be reduced from nine to eight cents per kilowatt-hour, and the second block from three to two cents per kilowatt-hour. The domestic minimum will become $1.75. The commercial first block rate will also be reduced to eight cents per kilowatt-hour, and the second block rate to two cents.

LUNENBURG (N.S.) town council has asked the Nova Scotian government to order the Nova Scotia Power Commission to adjust the wholesale price of electricity to the town. The council points out that the commission has failed to adjust the wholesale price of energy supplied the town in spite of frequent requests from the council representing the town during 1942, 1943 and 1944. The contract with the adjustment stipulation included was made between the town and the commission in 1921. The town council has also asked the provincial government to see that "the commission consolidates its various generating, transmission and distribution facilities within the province and thereby supply electrical energy to the province on a more economic basis.

•

DPC Increases Contract

DPC has authorized an increase in its contract with General Electric Co. of Schenectady, N. Y., to provide additional equipment at a plant at Everett, Mass., at a cost of approximately $3,650,000, resulting in a total commitment of approximately $12,150,000.

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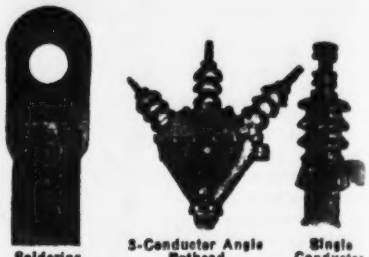

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REA Announces New Allotments

The Rural Electrification Administration has recently approved loan allotments totaling $580,500 to eleven co-ops in seven states, bringing the total to $514,932,301, of which $16,052,500 represents operations during the current fiscal year.

Two of the loans—Farmers Electric Cooperative, Inc., Greenville, Texas, $20,000, and Barron County Electric Cooperative, Barron, Wisconsin, $5,500—will be used for the purchase and rehabilitation of headquarters buildings. A loan of $80,000 to Southeastern Illinois Electric Cooperative, Inc., Harrisburg, Illinois, includes $7,000 for the installation of a substation and $73,000 for service extensions. The other funds, details of which are given below, will be used for the extension of electric service to farms located near present lines. No construction will be undertaken which does not meet with the approval of the War Production Board.

GEORGIA—Three Notch Electric Membership Corp., Donalsonville, $60,000.

ILLINOIS—Menard Electric Cooperative, Petersburg, $50,000.

MISSISSIPPI—Magnolia Electric Power Assn., McComb, $75,000.

NEW MEXICO—Sierra Electric Cooperative, Inc., Hillsboro, $100,000; Central Valley Electric Cooperative, Inc., Artesia, $30,000.

OHIO—Pioneer Rural Electric Cooperative, Inc., Piqua, $50,000.

TEXAS—Greenbelt Electric Cooperative, Inc., Wellington, $50,000.

WISCONSIN—Pierce-Pepin Electric Cooperative, Ellsworth, $60,000.

•

New Plastics Directory

A new 1944-45 directory listing 440 member plastics companies in the United States and Canada has been announced by the Society of the Plastics Industry, Inc. More than 700 different plastics products, with the manufacturers of each, are shown in the product index. In addition, the new directory includes for the first time a material index and a machine index, each containing the names of producers. The Who's Who in Plastics section lists hundreds of names and addresses of executive, sales and engineering personnel of member companies. The directory may be obtained from the Society of the Plastics Industry, Inc., 295 Madison Avenue, New York 17, N. Y., at $2.50 a copy.

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How are you at Chopping Trees?

No, this is no joke. Many businessmen have volunteered to aid the paper shortage by spending vacations from their companies in the timber country, helping out on the man-power problem in the paper pulp industry.

Not that you have the time to do this. Nor that tree-chopping is exactly in your line. But, until the man-power shortage in this vital industry is over, until our armed forces no longer are spread all over the world where food, ammunition and medical supplies must be shipped them in paper protection wrappers, there is a chopping job you must do. You must chop the use of paper in your business.

Sure, you've done plenty of this in the past months. But right now the need for paper is greater than ever. So the government asks you again to examine paper usage in your firm, see if you can't make even further savings.

And don't forget that baling wastepaper and sending it to a reprocessing plant is a most important part of the paper conservation job.

Remember—

PAPER IS WAR POWER

USE LESS PAPER—SAVE ALL WASTEPAPER

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

SEARCHLIGHT SECTION

POSITIONS VACANT

PRODUCTION ENGINEER — fractional h.p. electric motors. Should have specialty background in single phase motors, having devoted major effort to efficient mass production. Line will have limited size range. Engineering design experience desirable for development of motors for tooling and production. Permanent connection with outstanding [illegible] fornia manufacturer entering **household appliance** field. Send detail of experience and personal qualifications to A.W.A., Box 68, Station K, Los Angeles, California.

POWER STATION operator experienced in maintenance heavy hydraulic equipment, especially reaction turbines, required by Public Utility in Brazil. Should be capable taking charge of operation large modern hydro electric plant. Location healthy. Give complete resume experience, references, marital status and salary expected. P-763, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL DRAFTSMAN, experienced in overhead distribution and substation design; also one meter and relay technician, thoroughly competent to repair all types of protective relays, watthour and demand meters and laboratory equipment. Location, Northern Alabama. In reply state experience, age, references, salary desired and when available. P-789, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER, thoroughly experienced, to supervise design and purchase of equipment for large dry battery plant including erection and operation abroad. L. McCandless, Amer-Ind, Inc., 420 Madison Avenue, New York Tel. Pl 5-1953.

ELECTRICAL ENGINEERS — design and supervision of installations. Involves precision controls, servos, electronic amplifiers. Excellent war and postwar opportunity including chance to travel to West Coast and Pacific, if desired. Downtown Manhattan Engineering Office. P-793, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEERS—Operating Utility in Colombia, S.A. requires District Superintendent having hydro and diesel generation and preferably also electric distribution experience. Also Distribution Engineer, preferably with some plant experience. Knowledge of Spanish desirable but not immediate necessity. Positions permanent. P-797, Electrical World, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 34 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission's. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER. Graduate, age 42. American, good health, speak Spanish and unencumbered. Majority of past 21 years in supervisory capacity of design and/or construction distribution and transmission systems and industrial installations. Prefer foreign service. Available now. PW-778, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER, University Graduate, registered professional engineer, 20 years experience as industrial power engineer with large utility, interested in making a change. Would like position as power sales supervisor or assistant to sales manager. Could take charge of electrical maintenance in large industrial plant. Age 45, married, excellent references. Would consider South America or Mexico. PW-794, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER: Married, 3 children; 20 years utility experience, including transmission and distribution design and construction, system studies, property accounting; valuation etc., desire permanent location with utility or manufacturer as engineer or sales engineer. Availability; draft status and detailed experience record on request. PW-795, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

SALESMAN AVAILABLE

LATIN AMERICAN US graduate engineer 24 years experience in one of the most varied fields of power production and utilization desires position covering Latin American territory as traveling engineer for American manufacturer on salary or salary and commission. Age 45. SA-796, Electrical World, 330 W. 42nd St., New York 18, N. Y.

CHIEF ELECTRONIC ENGINEER

Company with seven years background in the field of designing and building automatic photo-electric equipment has Postwar plans that include a great opportunity for an individual who will be expected to handle developmental activity of electronic department. He will supervise electronic department personnel, coordinate activity of plant and field engineers, assume responsibility of entire department as executive head. Applicant should be thoroughly trained in practical as well as theoretical electronics, capable of supervising optical and electronic experimental activity. Should be capable of visualizing electronic coordination with mechanical equipment, able to assist design engineering in development of new units and supervise assembly, wiring, and eventual incorporation of units in completed machines; supervise installation of our machines in customers' plants.

P-785, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

INDIAN INDUSTRIALIST

Returning to India soon is interested in obtaining . . .

1. Exclusive sales rights of household and technical electrical lines for India. Distribution through well-known, active sales organization covering entire India.
2. Complete plants, processes or manufacturing rights for products that can be successfully manufactured in India.

Experienced Management and Capital available.

AMER-IND, INC.
420 Madison Avenue New York 17, N. Y.
Plaza 5-1975

Illumination Engineers

Design Engineer on Aviation, Marine and Floodlighting equipment—must be able to prepare specifications for manufacture and test of such equipment, also redesign of present equipment. Salary $215 to $300.

Application Engineer to analyze proposed illumination projects—must have electrical engineering background and experience on lighting problems. Will be expected to render engineering assistance on negotiations. Salary $215 to $300.

Write Supervisor of Technical Employment for application, 306 Fourth Avenue, Pittsburgh, Pennsylvania.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

WANTED

D.C. METERS—Type C6
A.C. METERS—60 Cycle

Send us a list of the D.C. and A.C. meters you wish to dispose of. We purchase large and small quantities.

The Electric Meter Corporation
Incorporated 1915
1776 Broadway, New York 19, N. Y.

EXPORT SALES ENGINEER

Excellent opportunity for experienced sales engineer who has travelled foreign countries, with thorough knowledge all types prime movers—steam, internal combustion, electric—offered by large western manufacturer with broad postwar field. Mechanical and electrical training essential, knowl-knowledge foreign languages, acquaintance foreign purchasing groups in Washington, D. C., or other large centers desirable.

SW-775, Electrical World
68 Post St., San Francisco 4, Calif.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED
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SALES MANAGER

for plant manufacturing large and small transformers. Must be an experienced salesman with some experience in the control of salesmen and agents and capable of handling correspondence with sales staff. Traveling required.

SW-784, Electrical World
330 West 42nd St., New York 18, N. Y.

COMMERCIAL PILOT

Commercial pilot familiar light and heavy ships desires flying position with engineering or construction firm. 15 years electrical experience utility and industrial companies. Will locate anywhere within reason.

PW-792, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

-TRANSFORMERS-

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

	HP	Make	Type	Volts	Speed
1—	1250	G.E.	MPC	550	130
1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	660	600
1—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	500	Whse.	Comren.	250	810/720
1—	350	G.E.	MPC	220	450
1—	300	G.E.	MPC	230	275/550
1—	250	Al. Ch.		230	525
1—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	MPC	230	250/450
1—	150	G.E.	RC-19A	230	800/1000
1—	130	Cr Wh.	CMC-65H	550	1200
1—	130	Whse.	SK-185	110	450/1340
1—	125	G.E.	CO-1832	230	625
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-38	230	600
1—	75/100	Whse.	SK-183	230	450/900
1—	75	G.E.	LC	230	500/1000
1—	75	Whse.	SK-183	230	560/1100
1—	60	El. Dv.	258	230	525/1050
1—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr Wh.	CMC-81H	230	300/900
1—	50	G.E.	RC-19	230	400/1200

TRANSFORMERS

	KVA	Make	PH	Type	Voltage
1—	1667	Pitts	1	OISC	13200x2300
1—	1050	G.E.	3	WCTH	11000x445
1—	525	G.E.	1	HJDD	2300x445
1—	500	Pitts.	1	OISC	13200x2300
1—	333	Moloney	1	C-OISC	22000/11000x2300/575
1—	333	Whse.	1	OISC	2300x460
1—	333	Pitts.	1	OISC	2400x220
1—	300	G.E.	1	H-RP	13200x575/1150/2300
1—	300	Pitts.	3	ODSC	4150x208/120
1—	300	Packard	1	OISC	2200x220/440
1—	200	G.E.	1	H-IDD	26400x115/460
1—	150	G.E.	1	HKS	440x115/230

MOTOR GENERATOR SETS

3 ph 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW G. E. 250 V. DC to 1400 HP 2300 V.
1—500 KW G. E. 250 V. DC to 700 HP—440/2200 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW GE 250/275 V. Gen. d.c. to 650 HP2300 V.
1—350 KW G. E. 220 V AC Gen. d.c. to 500 HP 250 V. DC motor.
1—300 KW GE 600 V. Gen. d.c. to 435 HP—2300 V.
1—250 KW G. E. 250 V. DC to 375 HP—440 V.
1—200 KW Whse. 250 V. Gen. d.c. to 300 HP—2300 V.
1—165 KW GE 70 V. Gen. d.c. to 160 HP—2300 V.
1—100 KW GE 125/250 V. Gen. d.c. to 150 HP—440 V.
1—75 KW GE 125 V. Gen. to 120 HP 1K 400/2300.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 Cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.E.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
1—	600	Al. Ch.		2200	720
1—	400	G.E.	TS-7647	2300	720
1—	150	Whse.		4000	1800
1—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
1—	800	Al. Ch.		440	885
1—	600	G.E.	MT	550	220
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	875
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	400	G.E.	IP	2200	252
1—	300	G.E.	IM	2300/4000	757
1—	250	G.E.	MT	4000/2300	257
1—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM	2200	575

Squirrel Cage

1—	300	Whse.	CS	550	880
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150
1—	100	G.E.	IE-13	2200	1800

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	900	G.E.	ATI	2200/6600	1200
1—	750	G.E.	ATI	220/440	900

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.

52 Church St. New York, 7, N. Y.

FOR SALE

ALL NEW IN 1943

Completely Equipped Electrolytic Hydrogen and Oxygen Plant

Capacity—55000 cu. ft. of hydrogen per 24 hour day.

Complete with—

1—450 KVA—G E. pyranol transformer 4160/440v. 3 phase 60 cycles
2—Motor generator set—Hanson Van Winkle Munning 450 H.P. G.E. synchronous motor, 440v. 3 phase, 60 cycle.
DC generator—40 volts, 8000 amperes.
DC exciter.
All mounted on same shaft.
1—Starting panel, switchboard, instruments, & busbars, etc.
1—20—electrolytic cells—Canadian G.E. Stuart type 7500 ampere.
1—3 ton Wright—overhead traveling crane—hand operated.
1—2 Nash Hytor gas pumps.
1—2—Single lift gas holders—700 cu. ft. & 350 cu. ft. with counter weights.
1—2—Single lift gas holders.
30,000 cu. ft.—5 inches static pressure.
15,000 cu. ft.—13 inches static pressure.
1—Continuous gas analysis recorder.
1—Flow meters.

BULOVA WATCH COMPANY

VALLEY STREAM, L. I.

J.L.HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

1602 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTORS

3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—225 HP, 1800 RPM, 220 volt, G.E. slip ring
1—200 HP, 600 RPM, 440 volt, Crocker Wheeler slip ring
1—200 HP, 600 RPM, 2200 volt G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
2—150 HP, 1800 RPM, 220 volt, Westinghouse slip ring

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 575 RPM, General Electric
3— 50 HP, 700 RPM, Crocker-Wheeler

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 650/2200 RPM, Westinghouse.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—12/18 HP, 350/1200 RPM, Electro Dynamic.
1—10 HP, 400/1600 RPM, Westinghouse, SK.
1— 5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, Synchronous.
1— 75 KW, 125 volt, General-Electric, squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh 7800/440 volt.
3—200 KVA, Allis-Chalmers, 2200/220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
4—150 KVA, G.E., 2400/240/480.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110.
2— 75 KVA, General Electric 3 phase, 4150 Y, 120/208Y.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 250 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—30 KW, 125 volt, Allis Chalmers.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

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received by 10 A. M. Thursday will appear in Saturday's issue, subject to space limitations.

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ELECTRICAL WORLD
330 West 42nd St., New York City

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ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y
Phone Roslyn 1220

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INFORMATION

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PROFESSIONAL SERVICES .....

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SEARCHLIGHT SECTION

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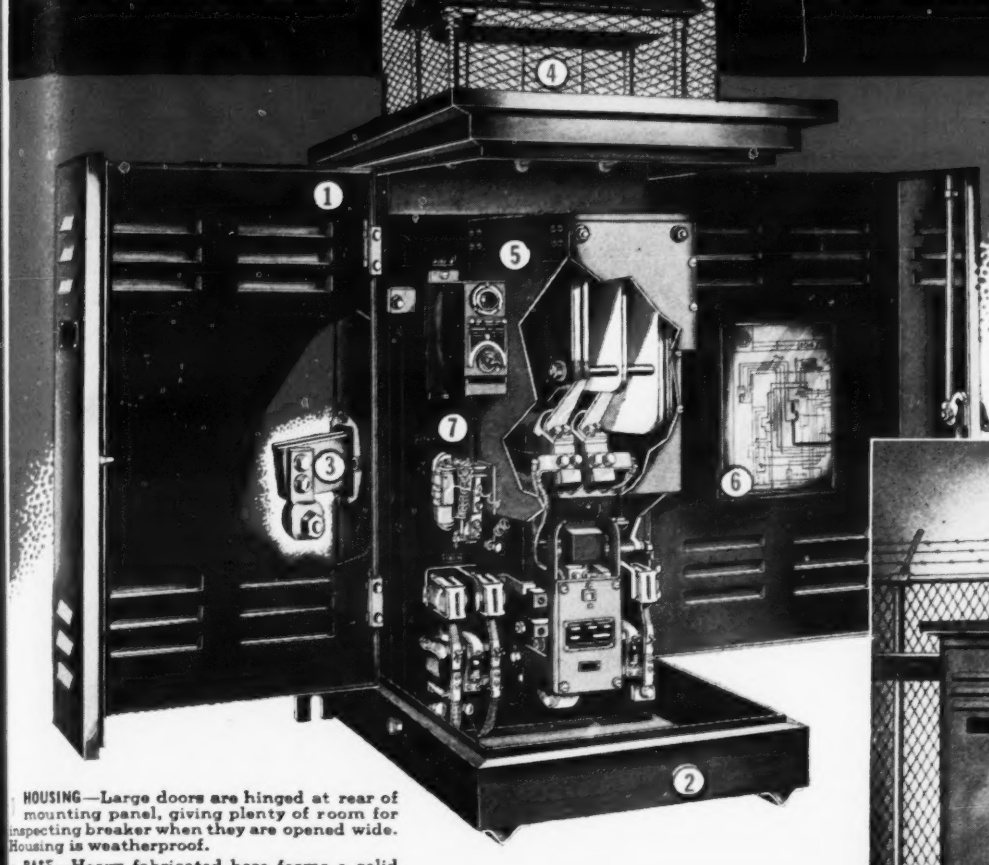
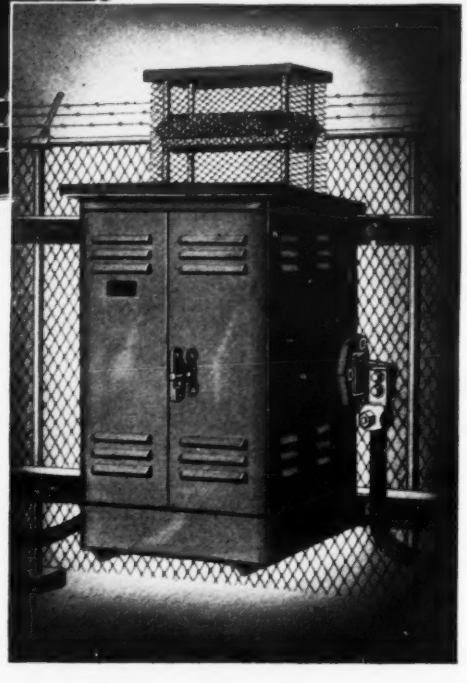
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

I-T-E Automatic Reclosing Circuit Breakers

MINIMIZE D-C POWER INTERRUPTIONS





1 **HOUSING**—Large doors are hinged at rear of mounting panel, giving plenty of room for inspecting breaker when they are opened wide. Housing is weatherproof.

2 **BASE**—Heavy fabricated base forms a solid support and the circuit breaker may be simply set on the ground. Runners permit moving breaker when this becomes necessary. Straps allow pole mounting if desired.

3 **CABLE CONNECTIONS**—Incoming and outgoing cables are located on each side at the rear. Connection bars slope downward from breaker and bushings are weatherproof. Solderless cable connectors are provided to speed installation.

4 **RESISTOR**—Bridging resistor is part of load measuring relay circuit that detects whether a fault exists and when breaker may be reclosed automatically. Screen housing provides full protection and ventilation.

5 **HOOD**—Hood protects circuit interrupting parts but is quickly removed for inspecting arc chute and contacts. Contacts are also readily removable using ordinary tools.

6 **WIRING DIAGRAM**—Wiring diagram is conveniently located in a holder with transparent plastic cover inside door. Always clean but ready for immediate use.

7 **RELAYS**—Relay equipment including load measuring and automatic reclosing control is provided to suit each installation.

These breakers are used to prevent unnecessary or needlessly prolonged interruptions to vital operations in mines, street railways, steel mills or wherever continuous d-c power service is important.

When applied to sectionalized tie-lines as an independent, stub end feeder, tie-feeder or multiple fed circuit breaker, only the section in which trouble occurs is out of service; others continue to operate. Furthermore, a load-measuring relay "feels" the circuit continuously after the breaker has opened and, when the overload or short circuit conditions have been corrected, the breaker recloses automatically. Power is restored without needless delay.

Ask your nearest I-T-E representative or write to I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa., for illustrated Bulletin 4404 which describes in detail the I-T-E Automatic Reclosing Circuit Breaker and its applications.

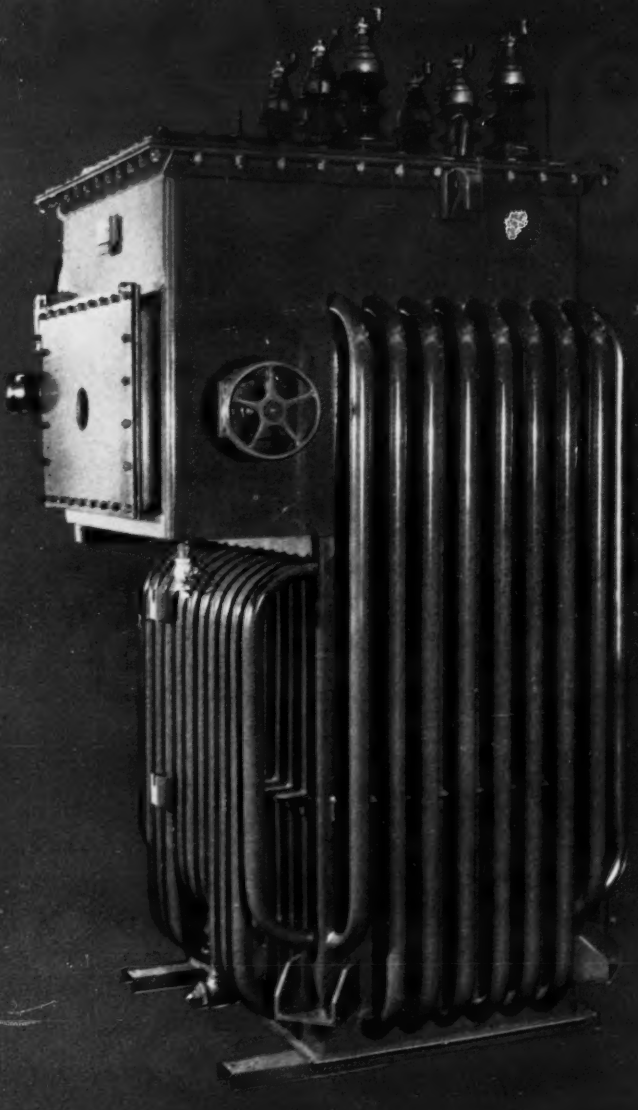
I-T-E REPRESENTATIVES IN ALL PRINCIPAL CITIES

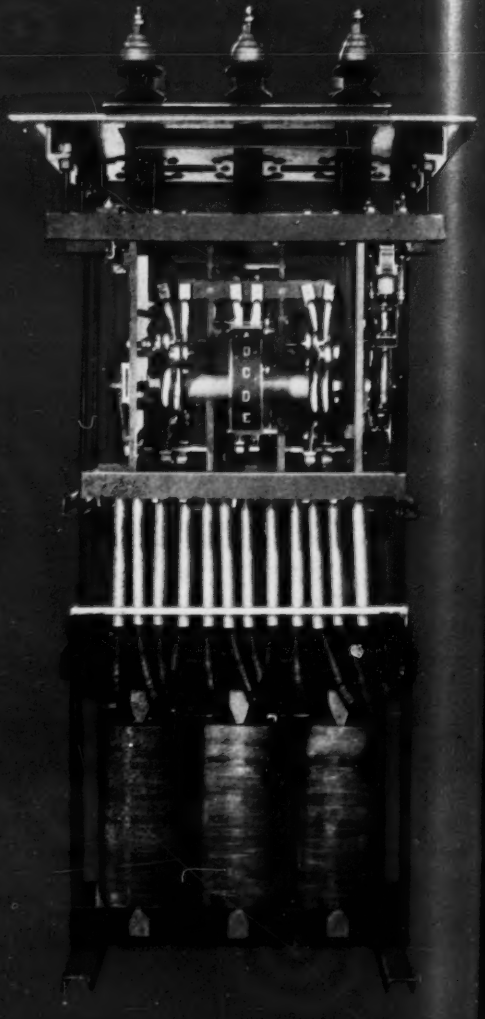
AIR SWITCHGEAR

ARMY NAVY

Inside and Out, Kuhlman Transformers are engineered and built to assure dependable trouble-free performance

IN Secondary side of core and coil of a 1500 Kva, 3 phase, 60 cycle, OISC Kuhlman Auto Transformer. 2300 volt output with 1800-1900-2000-2100-2200 volt input. Note tap dial which is operated by push button for tap changing under load.





OUT Exterior view of same transformer showing auxiliary tap changing hand wheel. Note rigid, sturdy construction of this transformer both inside and out which helps to explain why Kuhlman Power Transformers stand up on the job with a minimum of maintenance and repair.

Kuhlman ELECTRIC COMPANY • BAY CITY, MICHIGA

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